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DOCTOR OF MEDICINE

**Identifying and testing a conceptual model of the individual factors that influence patient safety learning for medical students**

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## Identifying and testing a conceptual model of the individual factors that influence patient safety learning for medical students

Lucy Jane Ambrose

2011

University of Dundee

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**Identifying and testing a conceptual  
model of the individual factors that  
influence patient safety learning for  
medical students.**

**Thesis submitted for the degree of Doctor of Medicine  
(MD)**

**Lucy Jane Ambrose**

**School of Medicine**

**University of Dundee**

**December 2011**

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I would also like to thank Peter, Daniel, James and Luke for their patience and fortitude over the last four years. In memory of Jamie Ambrose, a true patient safety pioneer, who died at the start of this series of studies and whose memory has inspired their completion.

## **Declaration of Authorship**

I hereby declare that I am the author of the work presented here and this thesis contains my own research. I have consulted the references cited. This work has not previously been accepted for a higher degree.

**Lucy Ambrose**

**2<sup>nd</sup> December 2011**

## **Thesis Summary/Abstract**

### **Introduction:**

The field of patient safety has increased in prominence over the last decade in response to information about the harm that occurs to patients in their journeys through healthcare. Healthcare education has also responded with the introduction of patient safety into many undergraduate and postgraduate curricula. Understanding how to influence healthcare worker behaviours is key to these responses. A vital area is the influence that individual factors have on patient safety behaviours. A model of the influences on patient safety has been proposed (Jackson 2008). There is little research in undergraduates that explores this area. This thesis presents a longitudinal series of studies following a cohort of students through a medical curriculum to answer the primary question: which individual factors influence learning about patient safety? Additionally to this how could these factors be tested in relation to patient safety for medical students?

### **Methods:**

The series of studies used the Medical Research Council's framework for the evaluation of complex interventions together with Kirkpatrick's framework to test a conceptual model of individual factors relevant to medical students in patient safety. Measurable outcomes relevant to medical students needed to be identified for each level in Kirkpatrick's hierarchy.

**Study 1** used focus group data, when the students were in year 1 of the curriculum, to identify the conceptual model of the influences on patient safety for medical students at level Kirkpatrick's level 1.

**Study 2** tested the conceptual model at level 2a when the cohort of students was in year 3. The study used validated questionnaires to test associations between reflective ability, and knowledge and attitudes to patient safety (Kember 1999, Patey 2007).

**Study 3** occurred in year five. This study identified associations between reflective ability, safe behaviours and error behaviours, in a standardised simulated ward setting. This was used to establish an association between individual factors and behaviours at level 3.

### **Results:**

**Pilot/Study 1:** The interpretation of data from seven focus groups involving sixty students identified reflection and intellectual development as individual factors which influenced learning about error.

**Study 2:** Sixty-one students participated and the questionnaires showed acceptable levels of reliability; Cronbach alpha for the reflection questionnaire was 0.71 and the patient safety questionnaire 0.90. The following significant associations were demonstrated:

- Reflection and knowledge of actions to take for patient safety, correlation coefficient 0.44 ( $p=0.0002$ ).
- Critical reflection and intentions regarding patient safety, correlation coefficient 0.40 ( $p=0.0007$ )

**Study 3:** Forty-eight students participated and the self-administered questionnaires showed acceptable levels of internal consistency, Cronbach alpha for reflection was 0.70 and for critical reflection was 0.78. The generalisability coefficient for the judgments about safe behaviour was 0.84 and for the error behaviours was 0.52.

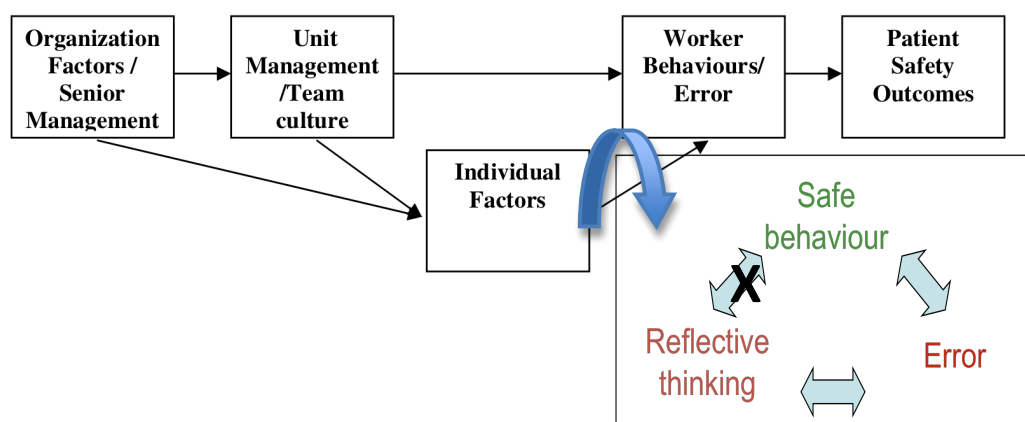
The following significant association was demonstrated:

- Reflection and knowledge based errors, correlation coefficient  $r -0.30$   
( $p=0.03$ )

There were no significant correlations between critical reflection and error, and reflection and safe behaviour.

### Discussion:

The results of these studies in a single cohort identify reflection as an individual factor that influences error behaviours as shown below add greater depth to Jackson's model (Jackson 2008). The link between reflective thinking and a reduced rate of knowledge-based errors appears to be associated with thoughtful action with reflection rather than critical reflection transforming meaning frameworks. This series of studies identify an association between reflection and error and give a new perspective on the use of reflection in patient safety education.



**Figure 1**

**Key factors influencing patient safety: Jackson, Flin 2009 and the conceptual model of reflection, error and safe behaviour**

## **Chapter 1**

### **The background to patient safety in undergraduate medical education**

#### **1.1 Overview of the chapter**

This chapter introduces patient safety as a concept in healthcare. It gives an overview of the influences on patient safety and how these have influenced how medical educators approach the delivery and assessment of patient safety teaching for medical students.

#### **1.2 Why has the term ‘patient safety’ arisen?**

‘First do no harm’ is a central premise of medicine believed to originate from Hippocrates and is often used to introduce the subject of patient safety. It focuses the great challenge for current and future practitioners to minimise risk to patients. Over the last two decades it has been demonstrated that doctors actions harm patients on a regular basis. Evidence has emerged from across the world, which demonstrates the level of harm that patients’ experience during their journeys through healthcare systems. Healthcare professionals have responded to this and the discipline of patient safety has emerged over the last two decades. This has now extended to medical students to improve their understanding of the risks for patients and to enable them to demonstrate the appropriate outcomes in the role of scientist, practitioner and professional to promote patient safety when they become doctors.

### **1.3 Why is there interest in patient safety?**

Between 10-20% of all health care encounters result in harm to patients (Leape 1991, Leape 1994, Wilson 1995, Kohn 2000, Vincent 2001, De Wet 2009). A worldwide movement has grown in response to these figures, which aims to improve safety and includes all involved across primary and secondary care. The emergence of the specialist field of patient safety has resulted in medicine seeking solutions to these problems from other industries. Much information has come from high-risk industries such as aviation and oil and expertise has now developed within healthcare. The initial focus was on health care delivery, with an emphasis on healthcare organisations and registered practitioners and this has gradually cascaded to undergraduate training across all health care professions. The World Health Organisation has been prominent in moving this forward and has published work in both research into patient safety and a patient safety curriculum for undergraduate medical students (World Alliance for Patient Safety 2008, Walton 2010). The introduction to this thesis will initially focus on patient safety in general and then discuss how the range of existing work in patient safety translates to medical students.

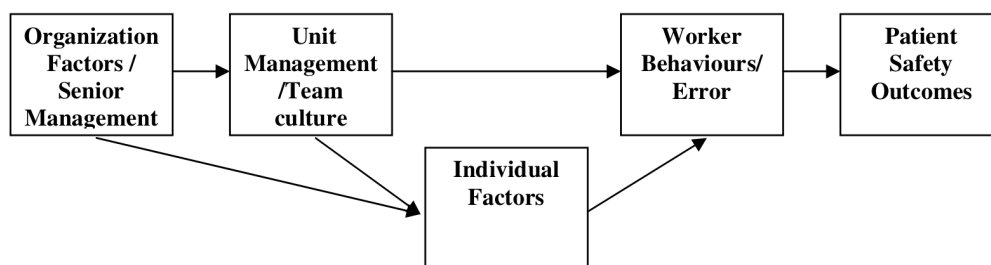
### **1.4 Defining Patient Safety**

The discipline of patient safety includes a range of terms and these are clarified at this point to help inform the remainder of chapter 1. Patient safety is defined as the freedom from accidental harm to individuals receiving healthcare. A patient safety incident is an episode when something goes wrong in healthcare resulting in potential harm or actual harm to patients. A patient safety solution is any system design or intervention that has demonstrated the ability to prevent or mitigate patient harm stemming from the processes of health care. Finally organisational resilience is the

positive side of safety, defined as the systems intrinsic resistance to its organisational risks. It can be seen that definitions of patient safety move from organisation to individual worker to the patient. There are many theoretical models of patient safety but the following one by Jackson and Flin helps to bring them together to give structure to the wide ranging concept of patient safety.

### 1.5 Key influences on patient safety and how they can be measured

The model described below by Jackson (Jackson 2009) includes all the fundamental aspects of patient safety and synthesises a range of theoretical models into a clear accessible model.



**Figure 2**

**Key factors influencing patient safety: Jackson, Flin 2009**

**Adapted from Brown 2008 Runciman 2007 Vincent 2006**

As a result this model gives focus to the steps, which can influence patient outcomes.

It reveals the influence of both organisations and individuals on patient outcomes.

This model is used throughout this thesis to give structure to the concept of patient safety.

The first challenge in patient safety is to establish how patient safety can be measured.

Therefore this section will focus on what aspects of patient safety can be measured

and how these are measured at present. In Jackson's diagram it can be seen that all

steps have an ability to be measured. However, as illustrated by the statistics in the first paragraph, the main focus has been on how many patients have been harmed and in what way. The focus on harm raises problems in measuring safe behaviours for medical students, who do not often have an impact on measurable patient outcomes. This is discussed later.

### **1.5.1 Organisational Factors**

Organisational factors are complex and work has gone into looking at the systems involved in healthcare to then identify outcomes at organisational level. This includes many of the measures described in the following sections. Measures at organisational level usually include a range of measures from sources across an organisation to give a global picture rather than an individual measure.

### **1.5.2 Safety Culture**

There is general consensus that the culture of an organisation teams and individuals will influence their different approaches to patient safety and their response to patient safety incidents. Assessment tools have been developed to test patient safety culture and attitudes within organisations and can help organisational development. The Manchester framework includes leadership, teamwork, accountability, understanding, communication, awareness of workload pressures and safety systems. The questionnaires in these studies have been validated with registered practitioners. The need for validated questionnaires, which can be used with medical students, has been recognised and two studies have been published which report the development and validation of attitudinal patient safety questionnaires for medical students (Flin 2009, Carruthers 2009). These are discussed in further detail in chapter two.



### **1.5.3 Individual factors and worker behaviour**

There are measures of individual factors and behaviours, which can be used in health care settings.

#### **a) Individual factors**

These can include testing practitioners' knowledge, measuring patient outcomes and looking at other indicators of safety. Individual practitioner's knowledge is important and patient safety is now included in Tomorrow's Doctors 2009 (General Medical Council 2009) and in postgraduate curricula. These result in patient safety forming part of summative assessments. In this way knowledge about patient safety can be measured. For professionals in practice patient safety behaviours can be measured within an individual's practice or within an overall practice setting. Assessing specific worker outcomes related to patient safety can do this. Patient satisfaction surveys, multisource feedback and analysis of surgeries and consultation skills can help to identify behaviours which might result in errors. Information from root cause analysis and significant event analysis can also be used for this. Makeham's work has a section on behaviours relating to the individual practitioner (Makeham 2008). This describes, in increasing detail, the types of event starting with distinguishing between practitioners' knowledge and skills. The section on practitioners' knowledge and skills may be applicable to medical students in both simulated and clinical settings.

Non-technical skills are an area of research interest in patient safety and measures have been explored in postgraduate medicine in anaesthesia and surgery (Fletcher 2003, Yule 2008). They identify a range of skills that can be measured such as situation awareness, decision-making, communication and teamwork and leadership.

## **b) Worker behaviours and error**

There are studies, which have focussed on error behaviours and ways of measuring error (Morey 2002, McCulloch 2009). These have been used in relation to assessing the impact of patient safety interventions. There are other measures of behaviour, which are used in healthcare settings. An example is hand hygiene audits which examine worker behaviours in relation to infection prevent and control. This area of work is very wide and varied and is explored further in later chapters. It involves a range of methods including direct observational methods.

### **1.5.4 Patient Outcomes**

There are two method of data collection that are generally used to identify rates of harm to patients. These are through incident reporting and by case note review and give insights into the types of harm patients' encounter (Leape 1991, Leape 1994, Wilson 1995, Kohn 2000, Vincent 2001, De Wet 2009). These methods are described below.

## **a) Incident Reporting**

Incident reporting is a system that where when an error is identified, it is reported either centrally across organisations, or within an individual organisation. Rates of harm can then be calculated and types of patient safety incident identified and categorised. If a specific problem is identified via this system, alerts can be issued which can be cascaded across healthcare settings. Identification of incidents via this process can be variable between practitioners and different organisations and traditionally incident reporting resulted in lower rates of incidents being reported.

**b) Case note review**

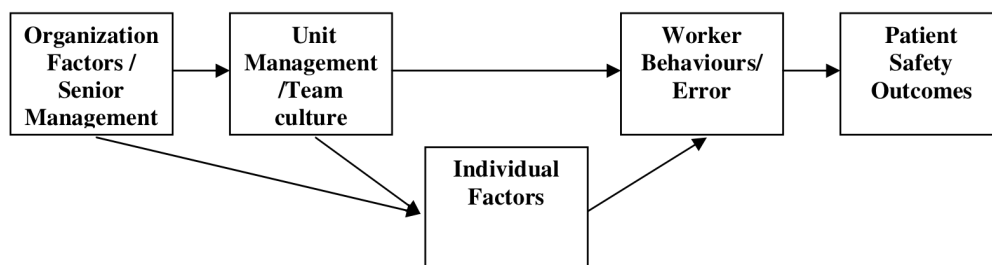
The evidence discussed above about rates of harm ranging from 10-20% have arisen using a different type of methodology, that of case note review. In this approach, triggers associated with harm are identified and then samples of notes are reviewed and rates of harm are then calculated. This approach generally results in higher rates being identified than via reporting systems and is a more consistent way of identifying harm. A tool called the Global Trigger Tool has been developed in the acute sector, which uses a series of triggers in patients' notes to identify if they have experienced iatrogenic harm. It has formed a vital part of patient safety initiatives in the United Kingdom to estimate rates of harm to patients in healthcare organisations. The National Institute for Innovation and Improvement in the England has developed a Primary Care Trigger Tool, which identifies a series of primary care triggers. The tool was developed under academic review but the evidence for the validation of the tool has not yet been published.

## 1.6 Responding to patient safety data

The statistics showing levels of harm to patients have resulted in organised movements in healthcare, which aim to improve patient outcomes and reduce harm. The response is wide ranging with a huge variety of activities. To understand how healthcare has responded it is helpful to return to Jackson's diagram of influences

Identifying the factors influencing patient safety helps to understand where problems arise and where interventions to improve safety have been targeted. The headings in this section again follow Jackson's diagram, which gives an overview of the main influences on patient safety.

These are helpful to review before considering how they relate to medical students. The analysis of the different section in Jackson's model covers each area in outline including important aspects that are relevant for medical students.



**Figure 2**

**Key factors influencing patient safety: Jackson, Flin 2009**

**Adapted from Brown 2008 Runciman 2007 Vincent 2006**

### **1.6.1 Organisational factors**

Frequently errors and adverse events occur as a result of organisational or system failures. The Swiss Cheese model described by Reason (Reason 1990, Reason 2008) demonstrates the potential for harm to occur from a series of failures within a system. Therefore reporting and learning from patient safety incidents allows both individuals and systems to learn and prevent further occurrences of error. All the tools, which measure harm, and identify how harm occurs, can allow organisations to learn about patient safety. Examples of these are root cause analysis and significant event auditing. Harm can also occur to patients within systems or at points of transfer between systems. Therefore any activity, which helps team members to understand the system they work and look after patients in, alongside the potential risks in these systems, can promote patient safety. These tools offer vehicles for learning for healthcare students.

### **1.6.2 Safety Culture**

#### **a) Patient Safety Initiatives**

This evidence and the approaches described above have been combined into programmes of work, which intend to reduce harm to patients across individual organisations. One of these was the Safer Patient's Initiative, which was programme funded by the Health Foundation UK (Health Foundation 2011). There have been a series of these programmes worldwide but the Safer Patient's Initiative was one the first introduced into the UK. NHS Tayside, which is Dundee University's partner healthcare organisation, was one of the pilot sites. Medical students had peripheral contact with this initiative as their clinical practice developed during the course.

## **b) Patient Safety Tools**

Patient safety tools are a patient safety solution, which have been developed for healthcare organisations and registered practitioners. The term patient safety tool represents a range of interventions, which have been used to transfer the evidence and theory outlined above, into practice, to reduce harm to patients. As such, they are patient safety solutions. They include a wide range of tools which impact on all of the influences described by Jackson and Flin (2009). Tools that can be used by individuals to influence work behaviours, have the possibility of helping students develop safe behaviours. The tools available include communication, information gathering, risk assessment and prescribing tools. They are implemented at organisational level with the intention of impacting on individual behaviours. Many act at individual level skill level, which can mean students can use them with patients as part of their learning.

### **1.6.3 Individual factors and worker behaviours**

There is large body of evidence emerging about professional behaviour, error and risk. Chapter 2 addresses evidence relating specifically medical students. In this chapter the intention is to give an overview of the evidence relating to patient safety in general. As can be above each of the influences overlap with each other and none are truly independent.

## **a) Understanding clinical risk**

Clinical risk is an avoidable increase in the probability of harm occurring to a patient. The rates of adverse events described above are predominately linked to error. Errors tend to occur when usual ‘defence mechanisms’, designed to prevent adverse events,

fail. If the risks are understood then these defence mechanisms can be made more robust to withstand different types of situation, which could result in an adverse event. Doctors are not alone in trying to reduce clinical risk. Risk management is the role of the whole health care team and organisations now have risk managers who work with health care teams to reduce risk. The counterbalance to clinical risk is clinical governance. Clinical Governance is described by Scally and Donaldson (1998 p. 61) as “A framework through which NHS organisations are accountable for continually improving the quality of their services and safeguarding high standards of care by creating an environment in which excellence in clinical care will flourish.” Clinical risk and clinical governance are often described in terms of healthcare organisations and are formally taught within undergraduate curricula in this context. Clinical reasoning, which is predominantly taught to medical students as part of learning the skills involved in the consultation process in medicine, includes these two processes and was demonstrated by Makenham (2008) to have an important role to play in patient safety. Makenham demonstrated that 30% of errors in a primary care setting were related to problems in clinical reasoning.

## **b) Error**

Error is central to patient safety. The field of error has emerged from different disciplines from both inside and outside of healthcare. Psychologists involved in safety in high-risk industries have been involved in shaping current understanding. A framework outlining the complexity of behaviour within individual practice has been described by Reason (Reason 1990, 2008). It describes skill based, rule based and knowledge-based behaviours. Errors can occur in each of these behaviours. One of the main authors who has explored cognitive errors in clinical practice is Croskerry

(Croskerry 2003) who has written extensively on the subject. He has written about how we reach diagnoses and make decisions about management in clinical practice and how errors can occur from these processes. He identifies two ways of thinking, using intuitive ‘rules of thumb’ or heuristics and metacognition. The process of metacognition incorporating analytical thinking is described as reducing the risk of cognitive errors. Over thirty cognitive errors are described which can occur in decision making. Understanding these and how cognitive forcing strategies can reduce the risk of error are vital for future practitioners who make rapid decisions such as doctors.

### **c) Being Open Approach**

Being open about safety incidents and adverse events has been shown to be beneficial for both patients and their carers, and for professionals. Patients are more likely to forgive doctors who are open about errors and the patients themselves are likely to experience less psychological symptoms if health professionals are open with them about what has happened. (Vincent 1993, Vincent 2002). How this may impact on medical students, again goes beyond the specific discipline of patient safety, into general communication skills training.

#### **1.6.4 Patient outcomes**

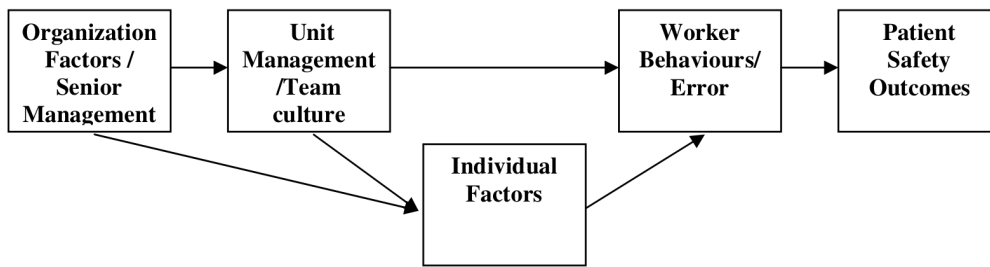
In 2006 Sir Liam Donaldson wrote in the foreword to *Safety First*: ‘Let us not forget that the most important lens for viewing the cost of our lack of progress is the impact on patients and their families. They are the ones who are harmed and sometimes die as a result of unsafe care. They are the stark reality of patient safety and the human face behind the statistics’ (Donaldson 2006 p.5)



We now have methods to measure harm to patients so that in turn we can implement changes in health care organisation and with registered practitioners to try to prevent the harm from occurring. We also need to understand how to respond to error when it occurs. Patient stories, which are narratives from patients who have experienced harm have been shown to be very powerful in helping organisations and individual practitioners understand that their response can have a huge impact on the individual and the system. These stories can also be very powerful learning experiences for medical students.

The National Patient Safety Agency (NPSA 2009) runs the 'please ask' campaign which encourages patients to actively participate in making the care they receive safer. The role of communication in patient safety incidents is highlighted repeatedly. Medical malpractice insurers outside of the UK often request training in communication skills before being insuring practitioners. In the UK these insurers support training in communication skills (Medical Protection Society 2010). The Mayo Clinic has developed a conceptual framework of how patients and healthcare workers interact to reduce risk (Longtin 2010). Communication and feedback are central to moderating the risks related to health care worker or patient related factors. Communication is key element of all medical courses. Again the overlap between established aspects of medical student training and the newer discipline of patient safety are evident here.

### 1.6.5 Summary of Jackson's model



**Figure 2**

**Key factors influencing patient safety: Jackson, Flin 2009**

**Adapted from Brown 2008 Runciman 2007 Vincent 2006**

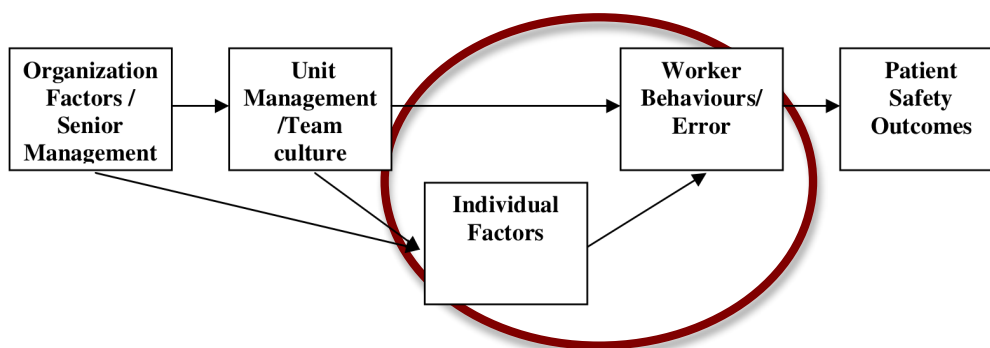
The model suggests the influences on patient safety. How to improve patient outcomes is less clear. The disciplines of health services research and quality improvement strive to reduce the harm rates discussed above. There have been many successes in specific areas such as infection prevention but there are many patient safety areas, which require further work. Health care educators have also responded to this situation as outlined below.

### 1.7 How does patient safety affect medical students?

All aspects of patient safety have relevance to medical students. All medical training is there for the purpose of developing future practitioners for whom the safe care of their patients is their first priority. Medical schools have a dual role in patient safety. Firstly they must have policies and procedures in place to ensure that students whilst learning do not place patients at risk. Secondly they must ensure that their curricula help students to develop the range of knowledge, skills and attitudes required for safe medical practice. The literature to help inform schools has been limited and this is discussed in chapter 2.

### 1.8 Measuring patient safety in medical students

As was described early in this chapter, the measures of patient safety that are applicable to medical students are often distant from the patient. Returning to Jackson's diagram they impact at behaviour level or at individual factor level, such as knowledge or attitudes towards patient safety.



**Figure 3**

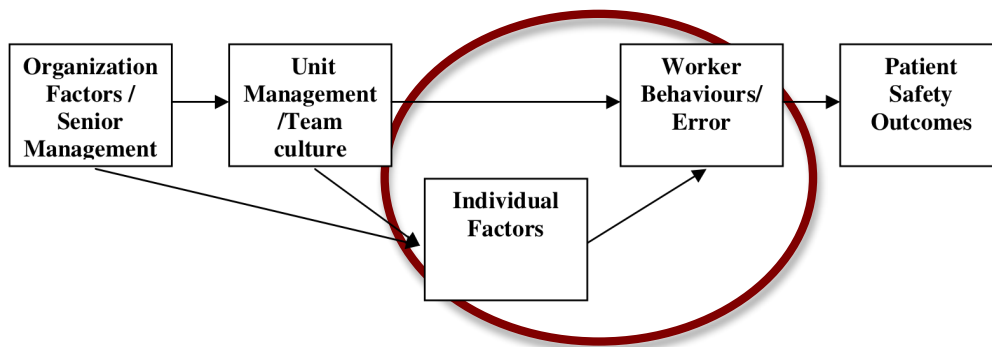
**Key factors influencing patient safety: Jackson, Flin 2009**

**Medical students behaviours and individual factors**

This raises the relationships between the specific discipline of patient safety and the development of good medical practice and the Tomorrow's Doctors outcomes as outlined by the General Medical Council (General Medical Council 2009), all of which have the overall intent of preventing harm to patients. Many measures that have been developed for the assessment of good medical practice are applicable to patient safety. After measuring harm the next task is to identify what other measures are available. Clarification of the influences on patient safety can inform how patient safety in medical students can be measured. This is explored in chapter 2.

### **1.9 Gap between medical training and current patient safety knowledge**

As demonstrated above, there is gap in the types of measurement that can be used to measure patient safety in the workplace and those available for medical students. The types of measure applicable to medical students are measures of knowledge, attitudes and skills. Returning again to Jackson's diagram the connection between individuals and workplace behaviours is relevant. The area where medical schools are most likely to influence patient safety is shown in the diagram below with the red circle.



**Figure 3**

**Key factors influencing patient safety: Jackson, Flin 2009**

### **Medical students behaviours and individual factors**

This situation raises a dilemma. On one extreme all “medical” behaviours might be considered to be relevant to patient safety and on the other only a narrow “patient safety” lens could be applied. Neither of these is either feasible or desirable. The concept of patient safety needs to be constructed in a way for medical students that is understandable and achievable. The dynamic between worker behaviours and individual factors is complex and not fully understood at either undergraduate or postgraduate level. Chapter 2 examines the evidence that can be applied across Jackson’s model (Jackson 2009) in greater detail.

### **1.10 Setting of the studies presented in the thesis**

NHS Tayside was one of the first pilot sites (Health Foundation 2011) for the patient safety initiative called the Safer Patient’s Initiative. The programme was supported by the Institute for Health Improvement (IHI) in Boston, USA. Via the use of patient safety tools, a programme of change was introduced to address areas of harm

identified within NHS Tayside. The MBChB course in Dundee works with NHS Tayside and so medical students were introduced to the patient safety tools early in the curriculum in order to support the development of safe practice. The studies described within this thesis started from the introduction of this programme and the subsequent reactions of the students to it. They are a longitudinal series of studies following a single cohort of students through the Dundee curriculum in a series of studies in years one, three and five of the curriculum. The studies sought to explain the students' initial response in year one in terms of educational theory. Subsequent to this the studies then sought to clarify the dynamic between individual factors and students patient safety behaviours through a series of studies.

- 1. Pilot study/study 1** – Qualitative data were analysed and interpreted to identify a strong negative response from the students to the introduction of the student patient safety programme in year one. From these data two individual factors that influence medical students learning about patient safety were identified.
- 2. Study 2** – The association between these individual factors and students knowledge and attitudes towards patients safety was tested in year 3 of the curriculum.
- 3. Study 3** – The conceptual model of individual factors was tested at skills and behavioural level in year 5 of the curriculum.

### **1.11 Thesis Goal and proof of concept**

The principal goal of this thesis was to understand the individual factors that influence learning about patient safety and how they can be measured. This was completed by following a cohort of students through the five years of a medical curriculum to

identify different types of measure at different levels within the curriculum. This method also enabled the identification of a conceptual model, which linked learning about patient safety to educational theory.

The definition of proof of concept is that its purpose is to verify that a concept or theory has the potential of being used in practice. This thesis takes individual factors identified from qualitative data and develops a conceptual model, and subsequently demonstrates its likelihood of reality in practice. A proof of concept may be small or incomplete, but the process of verification of a concept in a medical education context for patient safety is a challenge that requires investigation, particularly between individual factors and error behaviours.

This longitudinal series of studies will inform the field of patient safety about how the individual factor reflection interacts with safe behaviour and error in a cohort of medical students. The work described in this thesis has not been completed previously and as such contributes to both medical education and patient safety.

## **1.12 Chapter breakdown**

Due to the complex nature of this thesis a chapter breakdown is included to guide the reader through the chapters and how they have been developed.

Chapter 1 gives an overview to the field of patient safety and addresses some of the gaps in teaching and assessing patient safety in medical students. Measurement of patient safety outcomes is identified as a major aspect of patient safety that needs to be addressed. In addition this chapter introduces a model of influences on patient safety that is key to explaining this series of studies and their purpose.

Chapter 2 reviews the background literature available to inform medical educators about how to enable students to learn about patient safety. It identifies the complex nature of patient safety in terms of the literature available and the lack of evidence, which can inform medical educators about how to improve patient outcomes.

Chapter 3 reports the pilot study. This study identified the individual factors involved in learning about patient safety, which forms the basis of the thesis. This study resulted from a negative response to the introduction of a patient safety programme for year 1 medical students

Chapter 4 is a bridging chapter, which discusses the theoretical, contextual and methodological influences that were considered in order to identify and test the feasibility of the conceptual model in a way that addressed the gaps identified in the literature review.

Chapter 5 reports the second study, which took place in year three of the curriculum and tested the association between the individual factors identified in the pilot study and the knowledge and attitudes towards patient safety amongst the cohort of students.

Chapter 6 reports the third study which took place in the fifth year of the curriculum and tested the conceptual model at the level of behaviours in by testing associations between safe and error behaviours in a simulated ward setting and different levels of reflective thinking.



Chapter 7 discusses the results of all three studies in light of the methodological influences and the background literature. This chapter includes a critique of the methods.

Chapter 8 concludes the thesis with an overview of the findings and gives suggestions for further work in this area.

### **1.13 Summary**

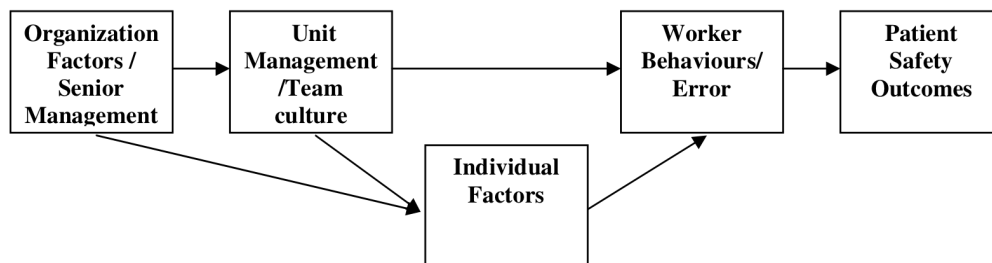
Patient safety is a vital component in the training of medical students. Students are often one step removed from behaviours which impact on measurable outcomes in patients care. The term patient safety encompasses a huge range of complex clinical activities. Therefore demonstrating the direct benefit to patients of patient safety educational interventions is challenging for medical educators. This thesis will present how two individual factors that influence learning about patient safety were identified. Following this the development of a conceptual model of the interactions between reflection, error and safety and its modelling with different outcomes in a cohort of students as they progressed through the Dundee MBChB curriculum is presented.

## Chapter 2

### Literature Review

#### 2.1 Overview of this chapter

Chapter one gave an overview of patient safety and introduced some of the evidence that is available to inform work in this area. However a more extensive literature search was required to analyse the available evidence in more detail. This chapter presents the literature available in the complex field of patient safety. It uses Jackson's model introduced in chapter one as a framework to present the evidence identified through the literature search



**Figure 2**

**Key factors influencing patient safety: Jackson, Flin 2009**

**Adapted from Brown 2008 Runciman 2007 Vincent 2006**

## **2.2 Search Questions**

In reviewing the literature the following question informed the design of the review:

How is patient safety taught and assessed in medical students?

This main question included a number of sub-questions:

- What subject areas are included in patient safety teaching?
- What teaching methods are used?
- How is patient safety teaching assessed?
- What works and how has this been demonstrated?

## **2.3 Search strategy**

The literature search was completed through a literature search of peer-reviewed literature and grey literature available in undergraduate patient safety and quality improvement teaching.

A search strategy was developed which reviewed the question in terms of population, intervention or educational aspects, and evaluation/outcomes (Haig 2003).

A decision was made to try to identify studies in the literature review that included outcomes relevant to patient safety. Patient safety includes a range of subtopics that have a large area of overlap with other subject areas in medical education. This would have resulted in a literature search that was potentially impossible to complete. A pragmatic decision was made to keep the review to studies that were relevant to the discipline of patient safety.

### **Inclusion/exclusion criteria**

Population	Undergraduate students studying medicine. This was defined as students engaged in a course of initial training that would result in them becoming registered medical practitioners. This would include graduate entry students on medical courses.
Intervention	Patient safety training, quality improvement training, human factors and error
Study types	Primary research articles of any study type including both qualitative and quantitative studies. No study was excluded by its design or as far as was possible, language.
Outcomes/evaluation	Outcomes that focused on the patient safety curriculum components, improvement of knowledge, skills, attitudes and behaviour related to patient safety were included

### **Key words used in the search**

Patient safety, quality improvement, human factors, Human error, medical education, undergraduate, pre-registration.

### **Search sources and strategies**

Overall Search strategy:

(Patient safety OR quality improvement OR human factors OR human error) AND  
(students OR undergraduate OR pre-registration AND medical)

Synonyms were used for each of these subject areas

Searches including synonyms were carried out in the following databases, MEDLINE, EMBASE, Cochrane Library, PsychINFO and Educational Resource Information Centre ERIC. In addition, the main education journals were searched

separately. These included Academic Medicine, Medical Education, Medical Teacher and Quality and Safety in Health Care, which focuses on quality improvement and has an education focus.

In addition internet searches were carried out using search engines such as Google Scholar. PubMed was also searched and specific sites were searched to find additional information from relevant patient safety sources including the Department of Health, Royal College websites, The National Patient Safety Agency, NHS Institute for Innovation and Improvement, Agency for Healthcare Research and Quality (AHRQ) and The Institute for Health Improvement, USA.

### **Assessment of study quality**

The initial assessment of each study included three questions:

1. Population    Is it about medical students?
2. Intervention    Is it about an aspect of training relevant to patient safety?
3. Study            Is it a primary research study that includes data?

Title and abstracts were screened using these questions. The studies identified through this process were considered and analysed in terms of Kirkpatrick's hierarchy (Kirkpatrick 2008). As discussed in chapter 1, many patient safety outcomes in the workplace relate to patient outcomes, which are hard to measure for medical students. Therefore the level of the outcomes described need to be considered for the papers identified. Kirkpatrick's hierarchy is a framework which helps to give structure to the evidence in terms of its proximity to patient outcomes and ranks them in order of importance. This is a valuable framework in patient safety and a useful way to

consider the outcomes that can be measured and their relationship with both the learner and the patient. In addition questions about quality were considered. Two frameworks were used; one for quantitative data and one for qualitative data (Kuper 2008, Buckley 2009). The questions are included in the appendices with the evidence table.

### **Kirkpatrick's Hierarchy**

An adaptation of Kirkpatrick for health professional education was used in this literature search to review the literature (Barr 2000)

Level 1: Participation—covers learners' views on the learning experience, its organisation, presentation, content, teaching methods, and aspects of the instructional organisation, materials, and quality of instruction

Level 2a: Modification of attitudes or perceptions—outcomes here relate to changes in the reciprocal attitudes or perceptions between participant groups towards intervention or simulation

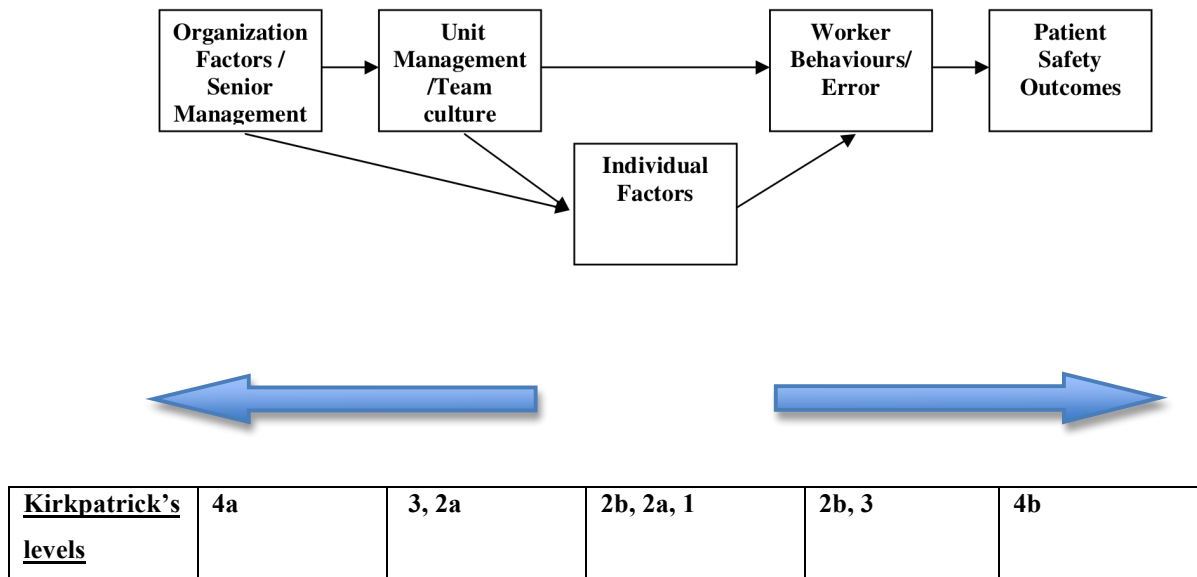
Level 2b: Modification of knowledge and skills—for knowledge, this relates to the acquisition of concepts, procedures, and principles; for skills this relates to the acquisition of thinking and problem solving, psychomotor and social skills

Level 3: Behavioural change—documents the transfer of learning to the workplace or willingness of learners to apply new knowledge and skills

Level 4a: Change in organisational practice—wider changes in the organisation or delivery of care, attributable to an educational programme

Level 4b: Benefits to patient or clients—any improvement in the health and wellbeing of patients and clients as a direct result of an educational programme

In addition Jackson's model was combined with the evidence table to help to structure the critical appraisal of papers, which reports outcomes relevant to individual factors as shown below.



**Figure 4**

**Kirkpatrick's Hierarchy appropriate to Key factors influencing patient safety:**

**Jackson, Flin 2009**

The relationship is not unidirectional, but as can be seen in figure 2.1, the two highest levels in Kirkpatrick are equidistant from individual factors in the diagram.

## 2.4 Search results

The literature search was repeated during the completion of the thesis prior to studies 2 and 3 and following the completion of study 3 to inform the thesis overall.

In the initial search in 2007, 423 papers were initially identified through the search strategy. When the titles and abstracts were reviewed duplications were removed and this resulted in 346 remaining papers. Of these, 51 full papers were read and 18 were included within the review of patient safety interventions, descriptive accounts were included at this stage and discarded later. The reasons for discarding papers included; not relevant to patient safety (213), not relevant to medical students (82). Eighteen intervention studies were included and are presented in sections 2.4.2 and 2.4.3. In the subsequent three searches 16 additional papers were included within this chapter and in the table in the appendices. In the most recent search in 2011, 791 papers were identified. This demonstrates the increased interest in this area in terms of publication. This chapter also contains sections that included other non intervention studies identified in the literature search that are relevant to patient safety teaching for medical students and those that relate to patient safety and educational theory in relation to Jackson's model. The literature was reviewed and and categorised into curricula subject areas and is presented below in the context of Kirkpatrick and Jackson's model. Study quality was also assessed using a series of quality indicators developed by Buckley (2009) for a Best Evidence Medical Education (BEME) review. In this framework, if studies met seven or more of the 11 indicators, they were considered to be of higher quality. A table of the studies and the BEME criteria is included in the appendices. The studies are presente din the order they appear in this chapter. A similar framework was used for the qualitative studies (Kuper 2008).



## **Studies relating to patient safety and medical students**

### **2.4.1 Curriculum development**

The development of a patient safety curriculum is an important area of work in the published literature. Individual aspects of patient safety have developed by individual curricula as described below and then there are significant pieces of work which have heavily influenced the whole patient safety movement including curriculum development.

One of the most influential reports into patient safety was the Institute of Medicine (IOM) "To Err is Human: Building a Safer Health System" which identified areas that have been used to influence curricula content (Kohn 2000). The themes described have been tested in the studies described later in this chapter.

- Establishing a national focus to create leadership, research, tools and protocols to enhance the knowledge base about safety
- Identifying and learning from errors through the immediate and strong mandatory reporting efforts, as well as the encouragement of voluntary efforts, both with the aim of making sure the system continues to be made safer for patients
- Raising standards and expectations for improvements in safety through the actions of oversight organisations, group purchasers, and professional groups
- Creating safety systems inside health care organisations through the implementation of safe practices at the delivery level. This level is the ultimate target of all the recommendations

The individual interventions described above are frequently the result of initiatives from individual departments or teachers based on information such as the IOM report.

Other papers have addressed the role of curriculum development. Some have adopted an approach such as used Australia for the postgraduate arena, which incorporates the evidence available into a performance-based framework by using a rigorous process (Walton 2006). Other have used expert consensus, which is frequently performed when there is insufficient evidence available in the peer-reviewed literature to inform the publication of an evidence-based curriculum (Kachalia 2006, Sanders 2007, Mayer 2009).

Kachalia (Kachalia 2006) developed a consensus from leading patient safety organisations as to which patient safety related practices should be incorporated into board certificate examinations in the USA. It is recognised that national assessment structures will influence curricula at both undergraduate and postgraduate level.

Sanders (Sanders 2007) used an international medical education conference to establish consensus about priority areas for medical education in patient safety. Their recommendations included approaches to increase knowledge of patient safety, including the causes and frequency, to develop willingness to take responsibility, to develop self-awareness of the situations when patient safety is compromised, to develop communication skills, especially inter-personal, and to develop team-working skills. This study was completed using audience response and as such its findings were limited to the sample of educators present in the room. This formed a convenience sample without information about the representativeness of the group.

Vangeest and Cummins completed a survey for the National Patient Safety Foundation in 2003 (Vangeest 2003). This was carried out in The USA and had two

sections for doctors and nurses. In the physician based section 131 physicians completed the survey. They also carried out a physician based focus group. Tolerance, denial and complacency were identified as barriers to improving patient safety and the role of professional authority in the medical profession affecting safety and a historical reaction, which accepted that error was inevitable. The importance of experience was identified. The survey identified a curriculum that included:

- Defining healthcare error and patient safety.
- Technology and patient safety.
- Human factors: dealing with complexity, product design and complexity, and fatigue.
- Physician-patient communication.
- Communicating within the healthcare team.
- Learning from mistakes: error reporting and analysis at the system level.
- Disclosure of errors and injuries to patients and families.
- Financial and legal implications of healthcare error.
- Error as an issue in medical education.
- The need for systems thinking and cultural change.

This study has been influential in terms of curriculum design although it is questionnaire-based design.

In terms of undergraduate curricula, a consensus has appeared which identifies a number of specific areas which in the UK have been included within the General Medical Council document, Tomorrow's Doctors 2009 (General Medical Council 2009). The broad range of topics identified through these methodologies mean that patient safety is treated not only as a single discipline in curricula, such as teaching

about error, but is widely integrated across all curricula areas. The papers themselves use a variety of methods to identify the curricula. All are based on expert opinion apart from Walton (Walton 2004) who used an approach of reviewing evidence-based papers to develop the framework. However the evidence that is used for this is from the postgraduate domain and so although applicable was not derived directly from studies with medical students. However it forms the most robust evidence to inform the development of patient safety curricula. It takes the approach of identifying performance areas which have evidence to inform practice and so it applicable to the structure of undergraduate curricula.

#### **2.4.2 Measuring patient safety outcomes in medical students**

As identified in the IOM report, measurement of patient safety is key to progress in patient safety. The methods available were described in chapter 1 and the lack of measures for medical students was also highlighted. There is a body of work, which has attempted to start to look at how patient safety can be measured in medical students.

Several studies use safety knowledge as a baseline measure prior to an educational intervention and were then re-measured at a later date. In these studies, patient safety knowledge measures were used to assess the educational impact of specific interventions rather than to comment on general levels of patient safety knowledge amongst medical students and trainees.

Kerfoot et al undertook a study using a 14 item validated questionnaire with the intention of establishing levels of knowledge in medical students and trainees

(Kerfoot 2007). The primary outcome measure was the level of patient safety knowledge demonstrated on the test instrument. The secondary outcome measure was their subjective perceptions as to their baseline knowledge level in patient safety. The study was carried out across seven institutions and included 640 participants. The results demonstrated that knowledge varied significantly with year of training and across a range of degrees and specialities. It also showed the participants were unable to assess their own knowledge deficiencies in patient safety. It rated highly on the BEME quality indicators. This study has importance in how knowledge levels about safety increase as individual's progress through medical training. It is also important in informing how to interpret other studies that use student perceptions of increased knowledge as a method of identifying the impact of educational interventions in patient safety. Evidence from other areas of medical education has shown that perceived levels of competence frequently do not match observed levels of competence (Evans 2004).

It has been recognised that many of the measures used to test knowledge and attitudes to patient safety have not been validated with medical students. Therefore recent work has established the validity and reliability of questionnaires developed to measure the knowledge and attitudes of medical students with regard to patient safety. Two questionnaires have been developed (Flin 2009, Carruthers 2009). They have both demonstrated acceptable levels of reliability and are important developments, which can establish baseline measures and then chart changes as students' progress through their medical courses.

### **2.4.3 Undergraduate patient safety teaching interventions**

The next section discusses individual components of patient safety and the evidence for each within undergraduate curricula. As described above there are a range of individual curricula areas which are important within patient safety and these have been used to form the subheadings within this section.

#### **a) Teaching about error**

Error is a very important area within patient safety and is one of the individual constructs of patient safety, which is often addressed as a single module in a curriculum. Therefore a number of studies have been published in this area. Halbach et al describes three years or cycles of data from the evaluation of a course which was delivered to third year students in the USA (Halbach 2005). The outcome measures described arise from the evaluation, which assessed students' perceptions of their ability to communicate with patients about error. Students' perceived confidence and awareness of their strengths and weaknesses improved following the module. As one of the earlier published papers in error, this study introduced the concept of teaching about error although its outcomes were only at the level of students perceptions. A review by Wong (Wong 2010) classed self-reported behaviours as level 3 but this seems different from other approaches to the analysis of the importance of research. In the approach used in this review, presented here in chapter 2, self-reported measures are classed as either level one or two depending on the study.

Madigosky et al (Madigosky 2006) describe a second year programme from the USA about errors and disclosure, which was evaluated using a questionnaire which assessed knowledge and attitudes and information about self reported behaviours.

The initial questionnaire at the end of the course showed an improvement in knowledge about errors and fallibility. The questionnaire was repeated one year after the course. This showed reversal in some items. The authors suggested negative influence of the hidden curriculum. The outcomes at the end of the study showed importance at level 2, however some of this benefit was lost over time. This built on earlier studies by raising the issue of the hidden curriculum and by testing outcomes at the knowledge and attitudes level in Kirkpatrick's hierarchy. The behaviours element within this study was self reported and as such does not rise above level 2. Wong (Wong 2010) again suggested that self reported behaviours reach level 3 but in the review this approach is contested.

Patey describes a one-day patient safety module delivered to final year students in the UK, which addressed error (Patey 2007). Student knowledge was assessed before the module and done year after the module. At one year knowledge had improved and so had perceived control over safety. This challenges the results of the Kerfoot study. The outcome of perceived control raises this study to level 2 within Kirkpatrick's hierarchy with the changes in knowledge and perceived control increasing after the intervention. This is an important study, which suggested sustained changes over time which is an important addition to the literature. Wong (Wong 2010) in their review placed this at level three.

Moskowitz describes a US study third year one day module on patient safety and errors (Moskowitz 2007). Attitudes and beliefs measured changed towards a more positive outlook on the importance of patient safety. Again this is at level one and does not add greatly to what was already published in this area. Varkey (Varkey

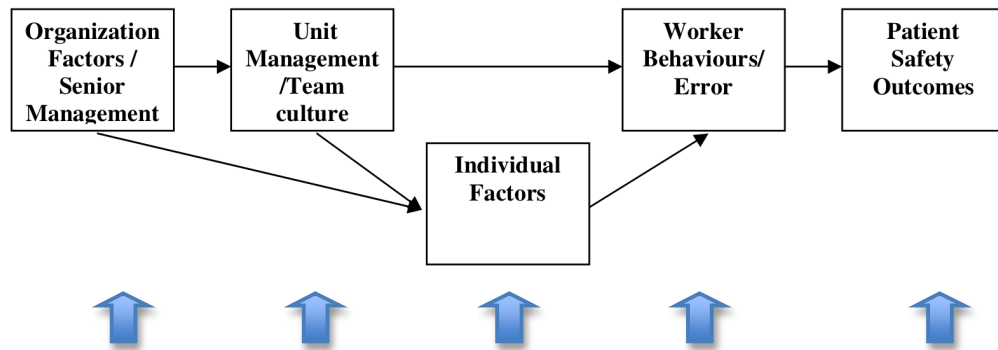
2007) introduced an objective structured clinical examination, which addressed communication about error. Information was not included about the assessment only about the evaluation data. In the evaluation students perceived their knowledge about communicating with patients about error had improved following the OSCE. Although this study again discusses level 1 outcomes, it adds to the literature by considering error teaching in skills settings. Gunderson (Gunderson 2009) used an educational module on error, which was evaluated via students perceived levels of confidence. Their perceived levels of confidence in disclosing medical errors improved following the module. This supports Patey's results from 2007.

Paxton also demonstrated that a workshop about error in a specialist area such as surgery can improve knowledge about error (Paxton 2010). This adds to the overall picture by considering one specialist area. This study followed up participants over a 1-year period and demonstrated a significant difference between the control group and the intervention group at 1 year. Hall (Hall 2010) reported the effect of patient safety booster conferences on a group of medical students with regard to their ability to identify errors and their attitudes towards error. It was identified that the 'booster' conferences improved students' ability to identify error. Again this demonstrated evidence at level 2 and adds to the literature in suggesting that the negative effects of the hidden curriculum suggested by Kerfoot can be mitigated via training.

These studies are all at level 1 and 2 using Kirkpatrick's hierarchy. The educational intervention by Patey (Patey 2007) is of interest in that the perceived levels of control remained high which shows a positive impact of the module. Others such as Madigosky (Madigosky 2006) show the influence of clinician culture and the hidden



curriculum on patient safety, which is vital to understand in order to address student learning in the workplace. As can be seen these studies help build on Jackson's influences (Jackson 2009) to show the influence of knowledge and attitudes and culture on individual factors



<b><u>Kirkpatrick's levels</u></b>	<b><u>Papers</u></b> <i>Subject area</i> <i>Author</i>				
<b>3</b>					
<b>2b</b>			<i>Error</i> (Halback 2005 Kerfoot 2007, Patey 2007, Hall 2010)		
<b>2a</b>		<i>Hidden curriculum</i> (Madigosky 2006)			
<b>1</b>					

**Table 1**

**Evidence achieving higher quality scores about error in medical students and key factors influencing patient safety: Jackson, Flin 2009**

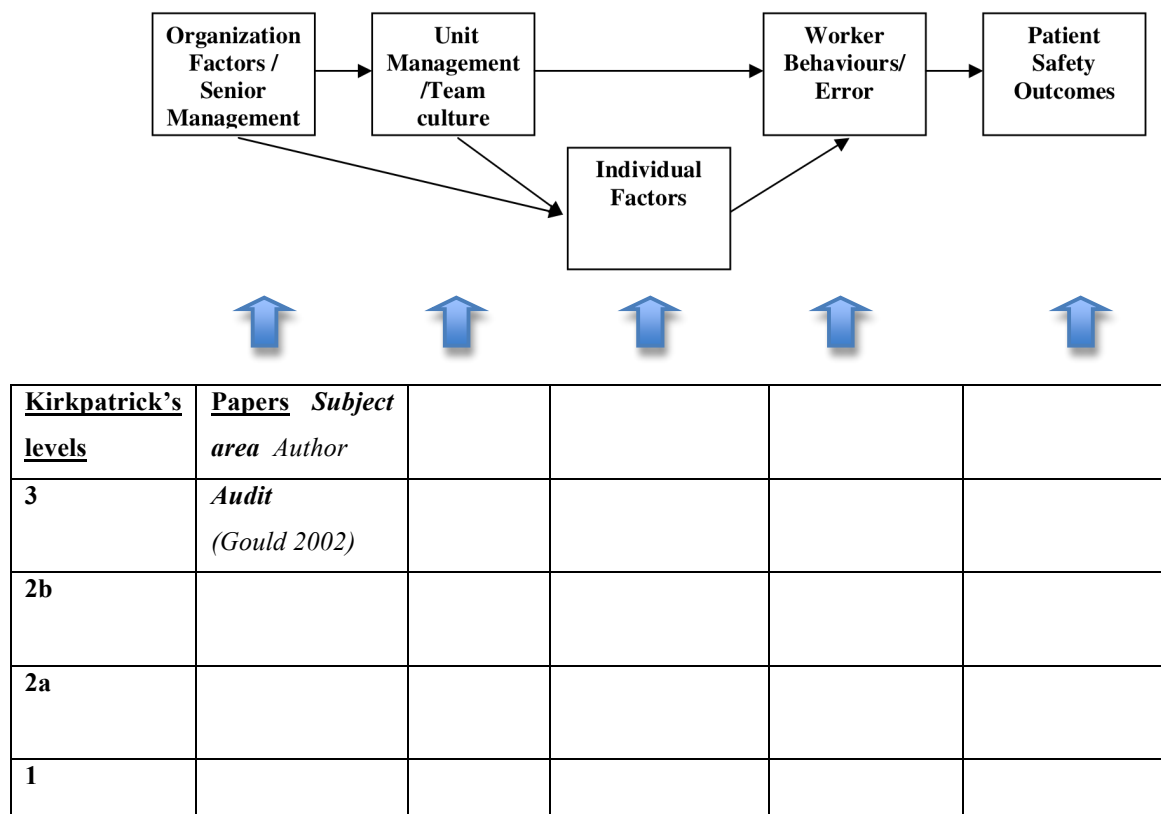
**b) Teaching about systems based care and quality improvement**

There is increasing literature in this area. The quality improvement movement has been increasing in its activity over the last ten years and it is now included in undergraduate curricula. Gould (Gould 2002) was one of the first studies, which investigated the effect of introducing quality improvement into undergraduate curricula. It is the study, which has tested to the highest levels in terms of Kirkpatrick. Students were given audits to complete relating to diabetes and then their placement providers implemented an improvement cycle. This resulted in an improvement in measures of diabetic control amongst the patients in the placements. Some authors such as Wong (Wong 2010) attribute this to Kirkpatrick's level 4, however the behaviours the students engaged in were skill based behaviours distant to the actual change in patient care and as such in this review are considered to have reached level 2b or 3.

Others have looked at quality improvement at organisational level. O'Connell described how a 3 yr course had introduced medical students to a managed care organisation via a series of lectures followed by a visit in year 3 (O'Connell 2004). An evaluation was carried out following the lecture-based activities on a yearly basis in years 1 to 3. This showed no change in perceptions of managed care following the factual information. However in year 3 there was an improvement in perceptions after the visit. The one-day visit to the managed care organisation resulted in a positive evaluation. Again this is at level 1 but suggests that sequencing of patient safety and improvement activities in a curriculum may be of importance to students' perceptions of such activities.

Fulton describes a short course (Fulton 2004), which included third year medical students in the USA, which addressed how a systems based approach could address issues about adverse event reporting. The evaluation suggested the difficulties students experience when considering their role within a system or organisation. This study adds to the jigsaw of information about students' reactions to patient safety.

Thompson (Thompson 2008) developed a curriculum for first year medical students on systems based safety. This six-step approach used student perceptions to develop the content of the curriculum, which match the headings within this literature search. This helps to triangulate the background literature in this area. All of these studies identify perceptions about systems based care.



**Table 2 Evidence achieving higher quality scores about systems based care in medical students and key factors influencing patient safety: Jackson, Flin 2009**

c) **Interprofessional learning and teamworking**

There is a group of literature, which addresses the value of Interprofessional learning in patient safety teaching. This literature mainly focuses on team working and its role in patient safety. This is an area again where there is increasing evidence in the postgraduate literature demonstrating the effect of educational intervention to levels 3 and 4 in terms of behaviours relating to errors and attempting to measure the effect of team training on patient outcomes. However, as shown below, undergraduate studies struggles to demonstrate outcomes above levels 1 and 2.

Kyrkjebø (Kyrkjebø 2006) reported a qualitative evaluation of 12 students from different disciplines that took part in a simulated session. The students struggled with roles, competencies and team skills, which the authors suggested required increasing the focus of team training and professional knowledge learning in education.

Cooper (Cooper 2005) describes a pilot study with first year students, which explored the theories of team working with the intention of enabling the students to learn with and from each other. It significantly raised awareness about collaborative practice and its link to improving the effectiveness of care delivery. The qualitative evaluation showed that it helped develop students' confidence in their own professional identity and the intervention helped them to value difference preparing them for clinical placements

Horsburgh (Horsburgh 2005) used an 2 day interprofessional activity to demonstrate the use of root cause analysis and a tool for interprofessional learning. It was only evaluated with students and faculty's views, which were positive. This short article

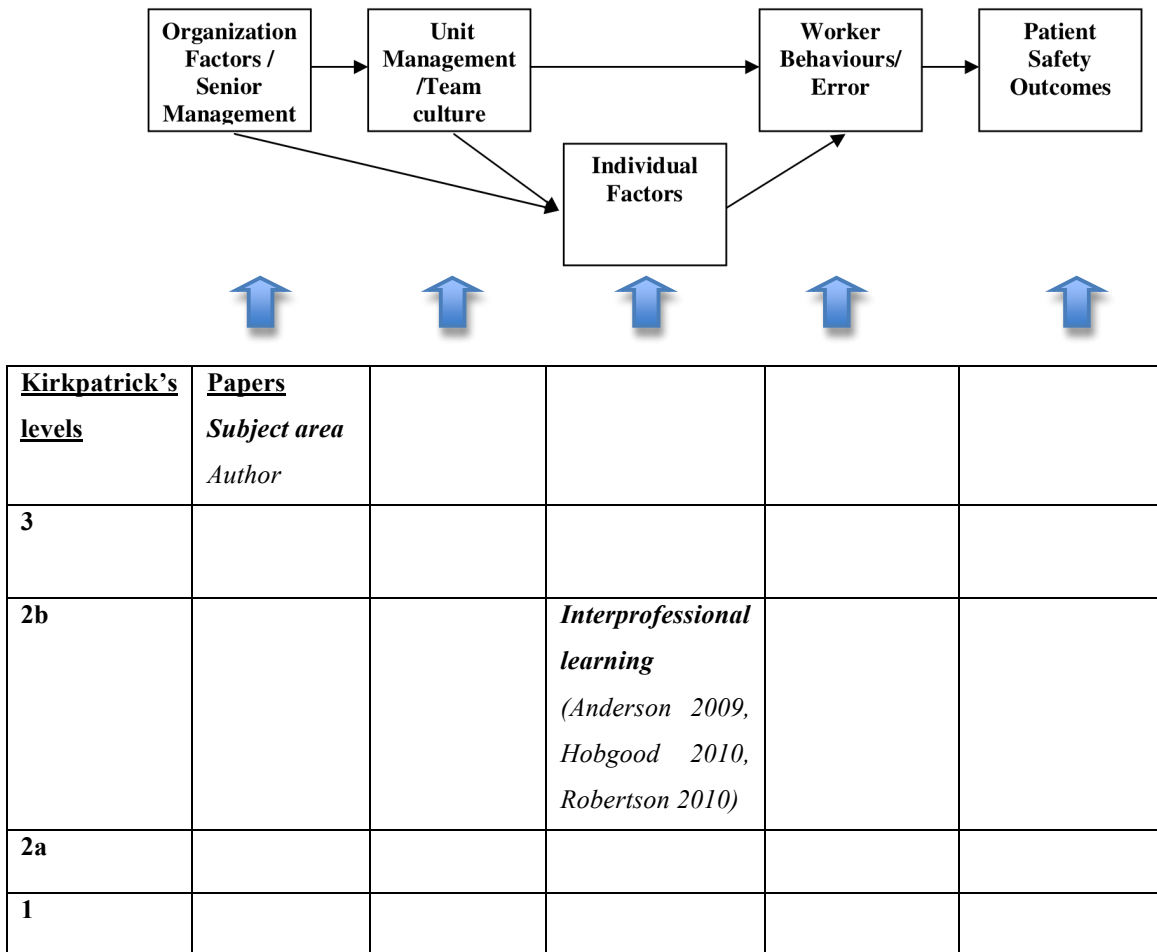
adds to the literature in informing that using the right learning activities  
interprofessional learning about patient safety can be acceptable

Ladden (Ladden 2006) gives a descriptive account of an interprofessional ambulatory care module. However there were no outcome measures described. Therefore this study adds little to the overall picture of patient safety training for medical students.

Structured team work programmes have been developed such as TeamSTEPPS which have been evaluated with medical students (Robertson 2010). These programmes have shown an improvement in knowledge and attitudes following the training. This was identified as being in the higher quality group and students were able to identify appropriate behaviours on video having participated in the training.

A UK based programme of interprofessional learning (Anderson 2009) demonstrated that learning in an interprofessional team improved knowledge. Again as in the evidence overall, these studies tested what is essentially a behavioural activity at knowledge level (level 2).

One study looked at teamwork skills behaviours comparing different methods of teamwork training from didactic as a control to low and high fidelity training (Hobgood 2010). They demonstrated improvement at knowledge level with all modalities but were unable to demonstrate a change in skills behaviours between the groups in the study. This is important in that the authors measured skills.



**Table 3**

**Evidence achieving higher quality scores about interprofessional learning and team working about patient safety at undergraduate level and key factors influencing patient safety: Jackson, Flin 2009**

#### **d) Medication Safety**

Prescribing is a skill, which is frequently transferred to the workplace late in a medical curriculum due to the fact that only registered practitioners can complete prescriptions. It is an area of huge importance in patient safety with many patient safety incidents arising from prescribing errors. Prescribing is made up of therapeutic knowledge and a complex set of skills relating to the act of prescribing. As with other subject areas in patient safety there has been consensus work to identify key aspects to include in a medical curriculum. This is dealt with here rather than in the curriculum section in order to preserve fluency in this chapter.

In the consensus statement from Agrawal et al (Agrawal 2009) five out of fifteen recommendations applied to medical students:

1. Provision of sufficient undergraduate learning opportunities to make medical students safe prescribers.
2. Provision of opportunities for students to practise skills that help to reduce errors.
3. Education of students about common types of medication errors and how to avoid them.
4. Education of prescribers in taking accurate drug histories.
5. Assessment in medical schools of prescribing knowledge and skills and demonstration that newly qualified doctors are safe prescribers.

Ross (Ross 2010) completed a consensus study using Delphi technique with experts in education and prescribing to establish a set of learning outcomes for prescribing.

The outcomes, which were agreed in the study, had a focus on safety, error reduction and communication.

Following the Audit Commision (Audit Commission 2001) report about prescribing there has been increased research looking at interventions, which will improve medication safety. The recent EQUIP study has also demonstrated the need for improved training in prescribing relevant to patient safety (Dornan 2009). This section will address work completed with undergraduates. At level 1 or reactions there have been studies using questionnaires directed to senior medical students or newly qualified doctors asking about perceptions about their training in prescribing as undergraduates. Coombes (Coombes 2008) identified that newly qualified doctors felt less confident to prescribe in high-risk situations. The questionnaire was completed by 100 doctors and also identified issues around fear of error and how an error would be dealt with raising the issue of culture around safety and disclosure. Heaton (Heaton 2010) used a questionnaire with 2413 UK graduates and identified that the most common method of learning as perceived by the graduate was opportunistic learning in clinical areas. The results demonstrated that the majority of students perceived this was too little and that they would not be able to meet the competencies for prescribing as set out by the General Medical Council. These perceptions are backed up by previous work by Celebi (Celebi 2008) who investigated the whether time spent in clerkships in internal medicine improved prescribing skills. Students were asked to complete drug charts for standardized patients and it was found that students from across all clerkships demonstrated the same errors.



The study by Varkey (Varkey 2007) was discussed in the error section but it also has relevance in medication. Students felt that the OSCE was a useful tool to aid error reduction in prescribing skills. The next stage is to identify from the literature which interventions impact on knowledge and skills at level 2b or level 3 behaviour in the workplace.

There are a number of studies which address prescribing knowledge and skills based on The World Health Organization's The Good Prescribing Guide, which aims to improve prescribing worldwide. This thesis is focused towards patient safety and so the studies discussed here, have a focus on safe skills or error reduction rather than general knowledge or skills relating to prescribing.

Two studies have shown an improvement in skills or a reduction in errors following an educational intervention to improve prescribing at level 2b (Denegan 2006, Garbutt 2006). Scobie (Scobie 2003) demonstrated an improvement in scores in a prescribing OSCE following a series of pharmacist led teaching sessions. However no p value is quoted so it is difficult to ascertain the significance of the results. These results give no clear indication about how to transfer skills from simulation to the workplace to reduce errors and improve safety.

A study using the patient safety tool, medicines reconciliation, with pharmacy students (Lubowski 2007) demonstrated at levels 3 and 4 a transfer of skills to the workplace and an influence on prescriptions with a reduction of errors. This study has not been replicated with medical students but suggests that patient safety tools can be used to facilitate the transfer of skills to the workplace.

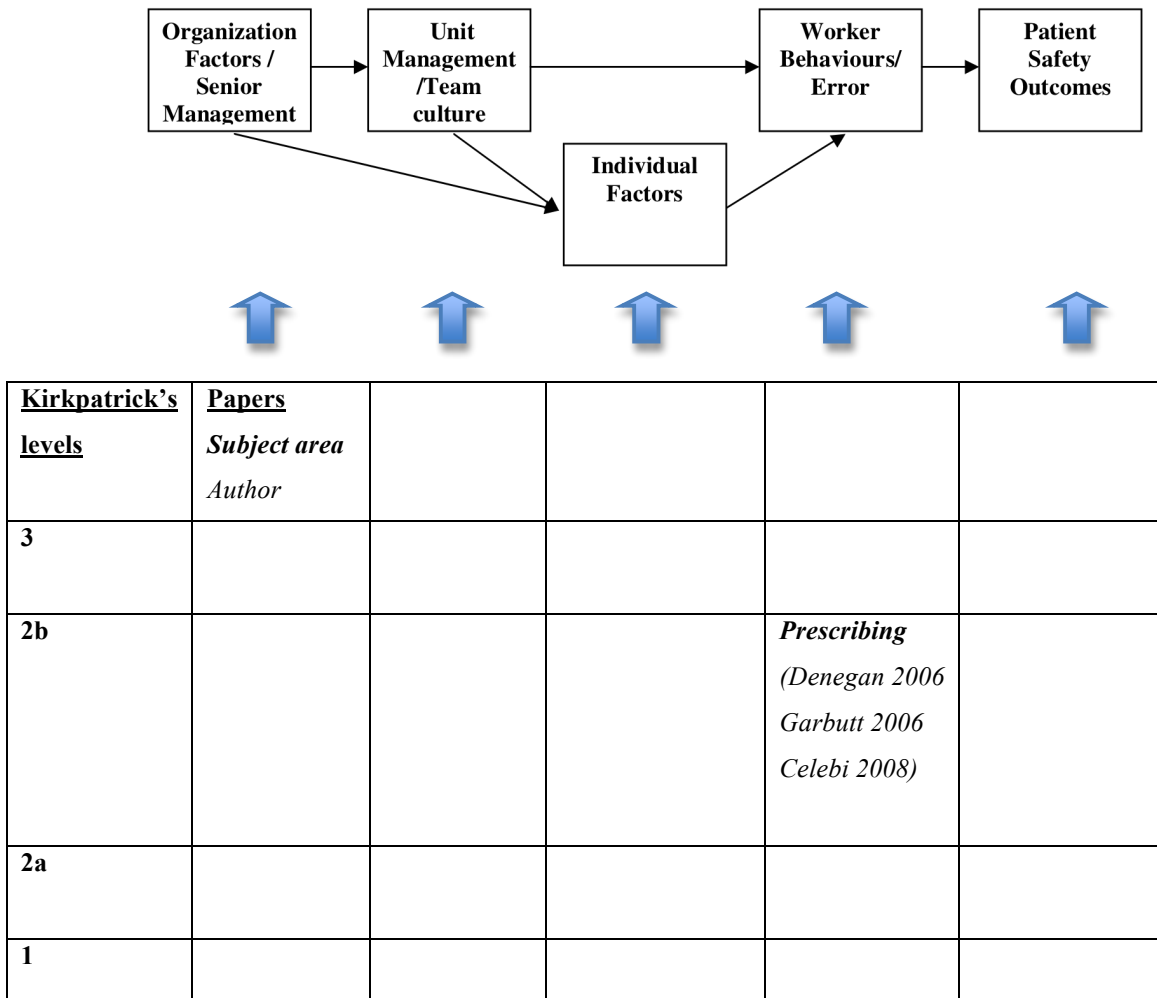


Table 4

Evidence achieving higher quality scores about medication safety at undergraduate level and key factors influencing patient safety: Jackson, Flin 2009

### e) **Infection prevention**

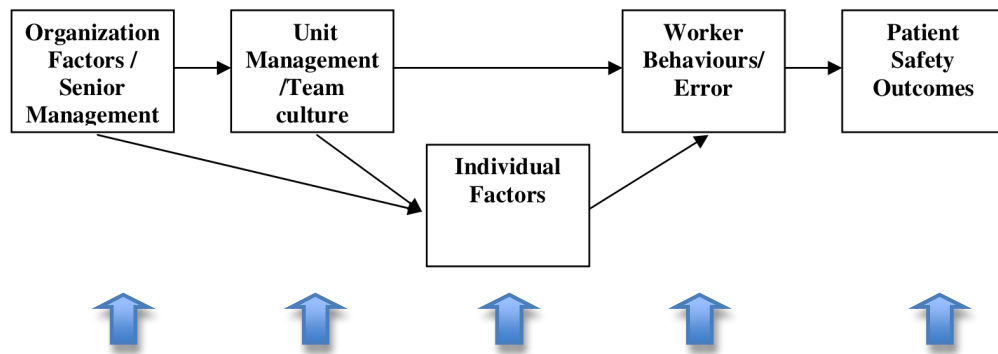
A survey in 2009 identified the need for an infection prevention curriculum to be developed and tested for medical schools (O'Brien 2009).

Two studies have looked at students' perceptions of hand hygiene, one in the UK in 2005 (Hunt 2005) and one in Singapore in 2010 (Fisher 2010). The different regions and the difference in time between these studies make interpretations hard to draw and the studies are at level 1. In the 2005 paper perception were negative but in the UK infection prevention has become very prominent in recent years following several high profile campaigns to reduce hospital-acquired infections and so these results may no longer be applicable. The study in Singapore showed more positive perceptions about hand hygiene than the UK based study.

A recent paper looked at the impact of an intervention on improving infection prevention at student reactions and skills. They demonstrated via the use of germ simulation that aseptic technique could be improved (Mittal 2011). This study showed how skills could be improved with simulation and so supports the use of simulation in training about patient safety.

Two studies have shown other aspects of medical student involvement in infection prevention. A study in the USA used medical students as observers of hand hygiene for audit purposes (Rosenthal 2009). They demonstrated that students could be trained in this manner and the results could be used for systems improvement. The final study in this section relates infection prevention theory to practice via a reflective process (Burnett 2008). Whilst these studies do not add directly to evidence rising up

Kirkpatrick's hierarchy they help to give direction for future work about research with medical students to give data with outcomes of wider significance (Kirkpatrick 2008).



<u>Kirkpatrick's levels</u>	<u>Papers</u> <i>Subject area</i> <i>Author</i>				
3					
2b				<i>Infection prevention</i> <i>(Mittal 2011)</i>	
2a					
1					

**Table 5**

**Evidence achieving higher quality scores about infection prevention and medical students and key factors influencing patient safety: Jackson, Flin 2009**

**f) Team Communication, clinical reasoning and patient safety**

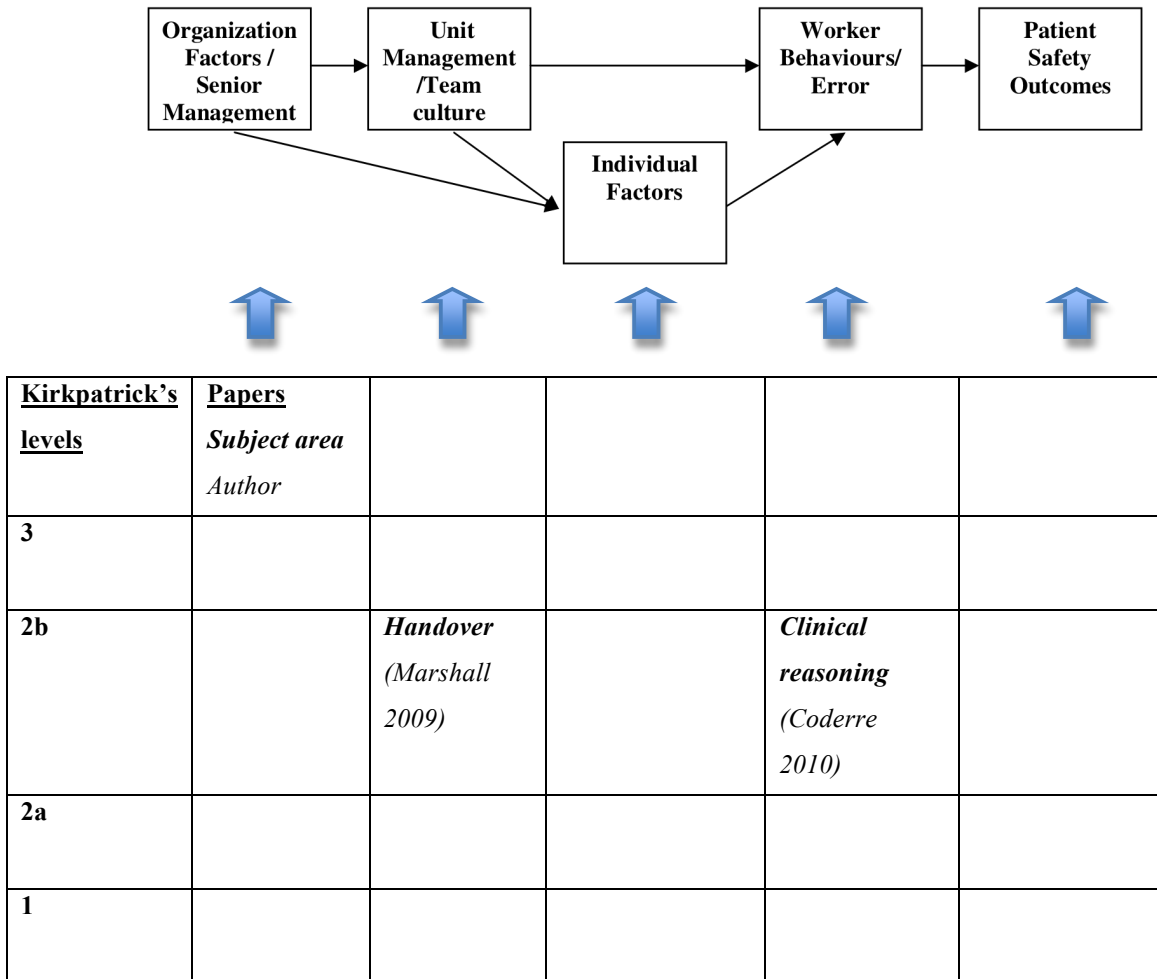
Communication is a large component of any healthcare curriculum and in medicine it forms the one of the cornerstones of the skills section of any curriculum. However as discussed in Chapter 1 identifying research relating specifically to patient safety with measurable outcomes relating to patient safety is challenging. Most research in this area focuses on the interaction between student and patient or simulated patient, in consultations, either in primary or secondary care. The purpose of the main bulk of the literature is not focussed on ‘patient safety’ as a separate discipline but on developing good communications skills. Therefore for this thesis the search focussed on patient safety as a discipline. The literature was searched for outcomes, which related patient safety in communication. The wider literature on communication is a huge area in the literature and stretches far beyond the focus of this thesis. The patient safety literature relates mainly to transitions of care and team working. The papers discussed above in the teamwork section are relevant (Kyrkjebø 2006, Robertson 2010). Non-technical skills are frequently dependent on communication and this was raised by Hunziker (Hunziker 2010).

Communication was also identified in the consensus statement about prescribing and in the study by Sanders and is widespread in the WHO curriculum (Sanders 2007, Ross 2009, Walton 2010)

One study demonstrated a change in content of handover after training in the use of the SBAR communication tool (Marshall 2009). This is a trial, which has sufficient power to demonstrate a difference between the intervention and the non-intervention groups. This study is at level 2b and demonstrates a change in skills in a simulated

setting. However this study raises a challenge to the levels as described. This is an important piece of work in medical education, and whilst it could be stated that it did not take place in the workplace, the successful completion of a trial in medical education should be noted.

Clinical reasoning is an area of current discussion in medical education and has relevance to patient safety. The relevance to patient safety was demonstrated in the study by Makenham (Makenham 2008) where approximately 30% of the errors identified in a primary care setting related to clinical reasoning. There is much discussion about whether this can be formally taught, and if you can teach it, how do you measure outcomes. This review does not look at the benefits of different types of teaching about clinical reasoning but reviews where it has been investigated in terms of error and patient safety. There is some work with medical students in this area and a recent study looked at errors in a paper based exercise where using a generic cognitive strategy. This involved asking students to query their initial diagnosis. This strategy resulted in fewer diagnostic errors (Coderre 2010). This may not represent what students do in practice but is an important aspect to consider in developing skills and behaviours. Therefore this study could be considered to be at level 2b and as such is an important addition to the patient safety research jigsaw puzzle.



**Table 6**

**Evidence achieving higher quality scores about team communication and clinical reasoning at undergraduate level and key factors influencing patient safety:**

**Jackson, Flin 2009**

**g) Other aspects of patient safety – Human Factors and Non-technical skills**

Curricula addressing individual aspects, which are not reported in the sections above have also been evaluated and published. These include human factors in surgery (Cahan 2010) and transitions of care (Bray-Hill 2010). The surgical clerkship human factors programme (Cahan 2010) did not demonstrate an improvement following the educational intervention between the intervention and control groups. Bray-Hill (Bray-Hill 2010) used an approach of small group interactive sessions to improve understanding of errors at transitions of care. They demonstrated an increase in confidence in managing transitions of care and the intervention was rated as more useful than other project work the students had engaged in.

Non-technical skills overlaps with human factors and is an area that has not been explored in undergraduate medicine and was a gap in the literature. The literature in this area is predominately in the postgraduate domain and may be applicable to undergraduate educators. The authors who are dominant in this area have also published in undergraduate medicine. The review purposely did not explore postgraduate evidence in any other area but due to the importance of non-technical skills in relation to Jackson's model and Flin's World Health Organization paper on human factors several key papers are included here. Flin (2009) published an overview on this topic but much of the original research is based in highly controlled clinical areas with anaesthetists and surgeons and as such the applicability of the results is limited for medical students (Yule 2008, Flin 2010).

## **2.5 Patient safety and educational theory**

All of the studies above identify patient safety as a discrete discipline to be measured as a separate entity. The intention in any medical curricula is to integrate knowledge,

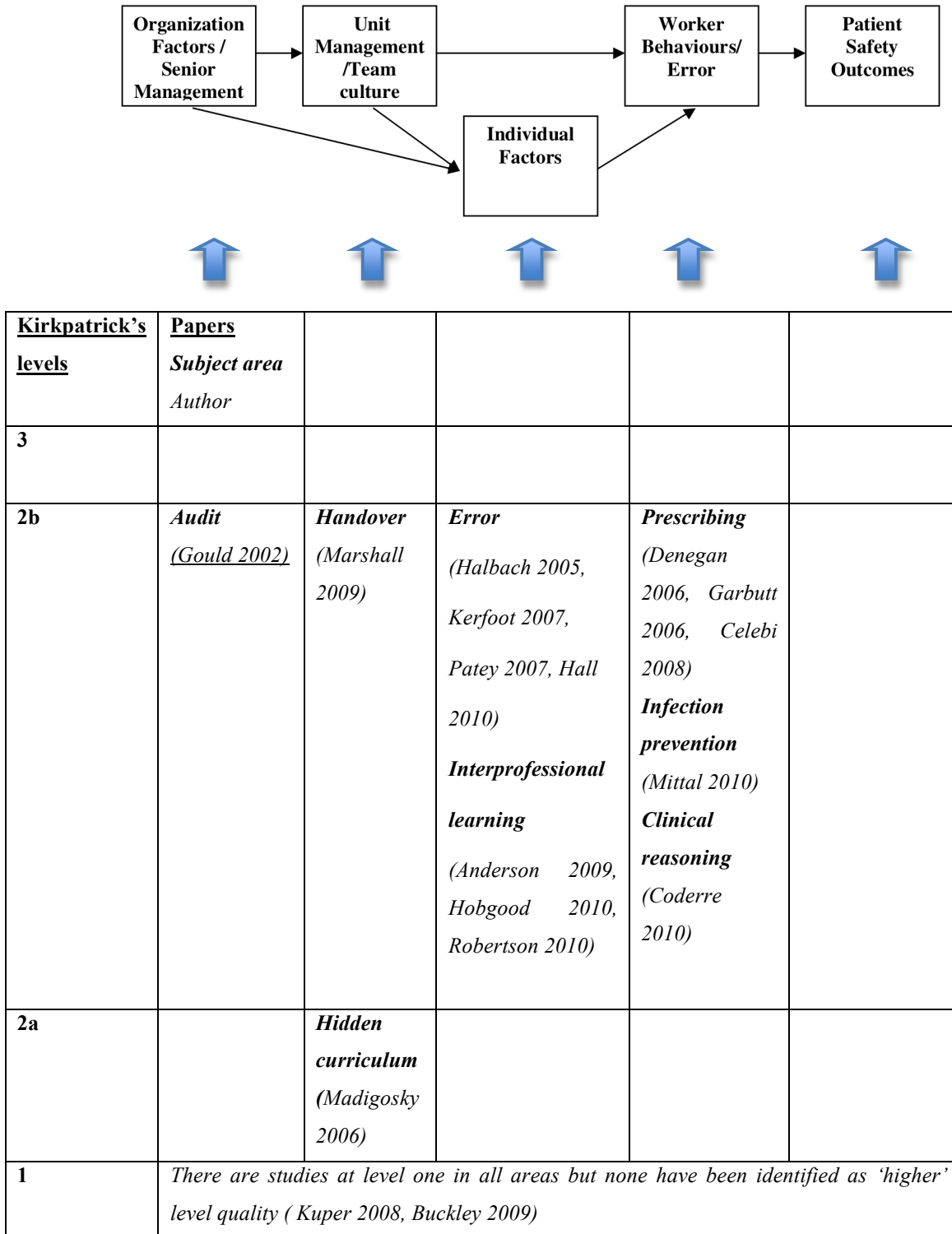


skills and attitudes to develop excellent clinicians. Therefore identifying how patient safety integrates into developing clinicians practice is essential. de Feijter (de Feijter 2010) used activity theory to understand the complexity of final year students learning about patient safety. This revealed a number of related themes including taking responsibility, communication, building up trust, hospital organisation, the balance between training and safety. This study moves research into patient safety away from an isolated discipline to a wider view of the complexity of learning about patient safety. Burnett (Burnett 2009) attempted to link theory to practice in infection prevention via the use of reflection.

The importance of these studies is difficult to classify but they start to make links between educational theory and patient safety practice.

## **2.6 Summary of the evidence for interventions for medical students to improve patient safety**

As can be seen from the diagram below the evidence to inform patient safety is a patchwork of pieces of information from a variety of different disciplines involved in education. The following table shows the range of literature identified as significant pieces of work in this review.

**Table 7**

**Evidence achieving higher quality scores reporting interventions to improve patient safety for medical students and key factors influencing patient safety: Jackson, Flin 2009**

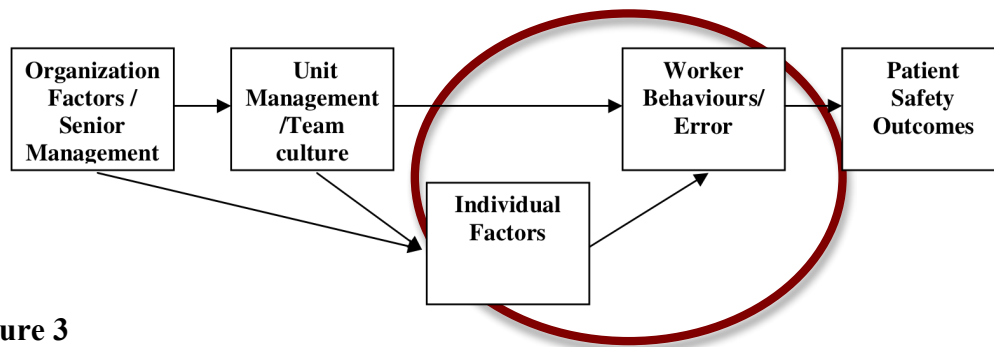
## **2.7 Discussion of literature**

The literature identified in this review has raised several issues about undergraduate patient safety teaching. They include the range of activities that can be perceived as patient safety related, the type of evidence available for educators and the outcomes, which have been measured. From the summary diagram above there is a gap in linking individual factors to behaviours or tasks. Individual skills have been addressed but the theoretical principles have not been widely included in the approach to research. As this review demonstrates the majority of the evidence is at level 1 and 2 and not at levels 3 and 4. However there is much discussion about the validity of using the hierarchy as a straight measure of quality of the evidence. The review has demonstrated important studies at Level 2, which are influential in understanding how to develop individual skills within patient safety. In medical education there is some discussion about the relevance of Kirkpatrick and there is also discussion about the quality of evidence relating to patient safety. By presenting the studies identified as higher quality (Kuper 2008, Buckley 2009) in terms of Kirkpatrick and Jackson in the tables throughout chapter 1, a gap can be seen. This combination of approaches enables the studies to be viewed with different ‘lenses’, to identify how they can inform educational practice. The different levels of Kirkpatrick cannot be viewed in isolation. Without evidence for the lower levels the higher levels do not have meaning for educators. An evidence table is included in the appendices.

## **2.8 Summary**

The challenge in this literature review is the breadth and scope of the patient safety literature. The search strategy was not very specific but appeared sensitive in terms of identifying relevant literature across a spectrum of subject areas in medical education

relevant to patient safety. The methodology of a systematic review is problematic in this setting and the methods used in a narrative review might be better suited to the subject area of patient safety. However in this thesis the initial intention was to complete a systematic literature review rather than a narrative review. Using the approach of a systematic review has meant the review has had a particular focus on patient safety specific areas. Chapter 1 identified the large areas of overlap for patient safety and general curricular areas, such as communication. However no studies were identified as having investigated patient safety and communication in undergraduates. To complete a wider review would make the review almost a review of the whole of the evidence for undergraduate medical education, which is not feasible in this setting.



**Figure 3**

**Key factors influencing patient safety: Jackson, Flin 2009 - Medical students behaviours and individual factors**

The following chapters will describe a series of studies, which examine the dynamic above in greater detail in line with the gaps in the evidence. The studies originated from a programme in patient safety introduced for medical students. There was a strong negative response, which indicated that a learning process was not progressing fluently. It was decided to investigate this to clarify the processes involved and to understand where they might have gone wrong.

## **Chapter 3**

### **Pilot study – Study 1**

#### **3.1 Overview of chapter**

This chapter describes the first or pilot study in this series, which was initiated with the intention of understanding the negative response to the introduction of a patient safety programme for year one medical students in the Dundee MBChB course.

#### **3.2 Context of the Study**

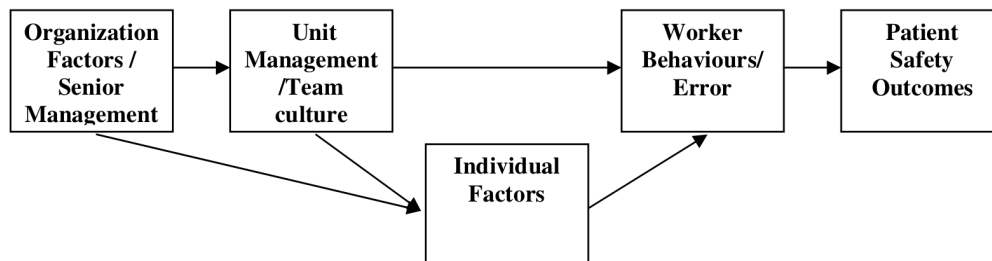
##### **3.2.1 Safer Patients Initiative**

The study presented in this chapter is set in the background of a patient safety initiative that occurred within NHS Tayside, which is the partner healthcare organisation to the University of Dundee's Medical School. The UK Safer Patient Initiative (SPI) was a programme, which addressed safety cultures within healthcare organisations within the UK (Health Foundation 2011). It was a collaboration between the Healthcare Foundation (UK), the Institute of Healthcare Improvement (USA) and four UK healthcare organisations to improve patient safety. NHS Tayside was one of four pilot UK hospitals that was selected to participate in the Safer Patient's Initiative where a programme of evidence-based change, developed by the Institute of Healthcare Improvement (IHI 2011) was introduced to each organisation.

##### **3.2.2 Patient safety Tools**

Patient safety tools were a major component of the patient safety initiative in Dundee. They acted as interventions to alter behaviours at various levels within Jackson's

diagram with the ultimate intention of influencing patient outcomes relating to patient safety.



**Figure 2**

**Key factors influencing patient safety: Jackson, Flin 2009**

**Adapted from Brown 2008 Runciman 2007 Vincent 2006**

NHS Tayside had five key priority areas of medicines management, infection control, critical care, general clinical ward areas and peri-operative care for patient safety.

Tools were identified and implemented in each of these areas with the intention of improving patient outcomes. These tools influenced behaviours at three stages in Jackson's diagram; organisation factors, unit management and team culture and worker behaviours.

### **3.2.3 Patient safety and medical education**

At the point in time when this was occurring in 2006 -2007, patient safety was becoming more prominent in medical training at both undergraduate and postgraduate levels. As discussed in chapter one this was in response to the data about harm to patients.

### **3.2.4 Patient safety in the Dundee Curriculum**

Alongside the increasing interest in patient safety within medical education, Dundee was undergoing a curriculum review and it was decided to include aspects of patient safety within the MBChB course. In a spiral curriculum core principles can be introduced in the early years and then subsequently built upon as students ascend the spiral. In most undergraduate medical curricula where patient safety has a specific module, it is placed later in the curriculum (Patey 2007). In Dundee it was decided to use the spiral and to start patient safety activities in year 1. This combination of circumstances provided an opportunity to involve first year medical students in collecting data about patient safety tools in ward settings for the Safer Patient Initiative. It was anticipated that this would introduce students into the clinical environment in their first year within a precise context and expose them to safe practice from the earliest stages of the curriculum and form the foundations of safe practice which could be built upon as they ascended the spiral curriculum.

This chapter describes the evaluation of the programme of patient safety activities using patient safety tools. This study was a qualitative exploration of students' experiences of participating in the student Safer Patient Programme.

### **3.3 Methods I**

#### **3.3.1 Design and Development of the Student Safer Patient Initiative (SPI) Programme.**

The student SPI data collection programme was designed for students to collect data in subject areas that were relevant to their year of study. As a result, they collected data in the areas of communication, hand hygiene, and recording of information in the context of patient medication.

The design and development of the Student SPI programme took place over a four month period in 2006. This is outlined in Table 1. the organisation of the programme was planned between members of the NHS Tayside patient safety team and a senior academic within the Dundee Medical Curriculum.



<b>Timescale</b>	<b>Process</b>	<b>Outcome</b>
Aug-Oct 2006	Proposal of programme	<p><b>Step 1:</b> Independent review of SPI activities by the lead researchers.</p> <p><b>Step 2:</b> Review of the current Practice Of Medicine programme</p> <p><b>Step 3:</b> A paper of intent was submitted to the UMEC and consent to proceed with proposed test of change with year one medical students.</p>
Oct-Nov 2006	Development of proposed programme	<p><b>Step 4:</b> Consensus was achieved on the four identified SPI activities to be incorporated into the proposed programme.</p> <p><b>Step 5:</b> The first draft of student learning outcomes for each of the SPI activities was developed.</p> <p><b>Step 6:</b> An iterative process with an expert focus group linked the first draft of student learning outcomes to the proposed PDSA data collection tools.</p> <p><b>Step 7:</b> The focus group outcomes led to the refinement and final selection each of the PDSA data collection tools.</p>
Nov-Dec 2006	Identification of clinical placement areas	<p><b>Step 8:</b> Identification and distribution of clinical ward areas within one NHS Tayside operating site for the students' placement.</p> <p><b>Step 9:</b> The development of standard briefing materials for lecturers, students and ward staff participating in this first test of change.</p> <p><b>Step 10:</b> Briefing of all clinical ward areas Senior Charge Nurses by one of the lead researchers. The briefing included a Staff Briefing paper, student timetables for the 4-week period, data collection tools and an overview of the purpose and outcomes for students were provided to each SCN to disseminate to all the clinical ward staff.</p>
Dec-Jan 2006-2007	Student materials	<p><b>Step 11:</b> The development of student information pack, which included student timetables, all teaching material and the four data collection tools were provided to each pair of students.</p>

**Table 8 Year 1 Patient Safety Student Programme: Development Timescale**

### 3.3.2 Patient Safety Tools.

The choice of the most appropriate evidence based quality improvement tools involved a review of the NHS Tayside patient safety initiative outcomes and the undergraduate medical curriculum outcomes to identify common areas. The key areas that overlapped with the undergraduate, medical curriculum were communication, infection control and medicines management. Confirmation of the selected tools for the development of this programme, was taken through an iterative process involving consultation with the lead researchers, members of the Clinical Skills Team and the SPI Director.

**1. Ask Me 3™** (Ask me 3 2011) is a communication tool to assist patients to ask of their care providers relevant questions about their treatment, care and health. The Ask Me 3 tool encourages patients to ask questions about their health from healthcare providers. This tool facilitates a structured process of patient/student interaction for the students' first experiences with patients in clinical settings.

**2. Hand Hygiene** Observational Audits of handwashing are vital in assessing the compliance with Infection Control strategies and policies. Infection Control, across a variety of healthcare situations is one of the main features of the UK Safer Patient Initiative. This tool continued the Infection Control theme across the curricula.

**3. Medicines Reconciliation** refers to the process of ensuring that on admission into hospital, patients' medications are accurate and validated with the primary/secondary care interface. (Vira 2006) This results in a reduction in medication error at the points of transfer across the patient journey. This was seen as a core area of care for students as it has been highlighted by the Audit Commission as an area of failure in medical curricula (Audit Commission 2001)

**4. SBAR** is a multi-professional communication tool adapted from a US Military communication format. SBAR is a simple and effective tool for healthcare practitioners to use in any given situation to ensure clear, relevant and concise patient information is passed across disciplines. The **S** represents Situation, **B** is Background, **A** assessment and **R** recommendations.

### **3.3.4 Implementation of the SPI programme.**

Students in year 1 were timetabled for one, two-hour ward session each week in the core eight week systems teaching in semester 2. The eight week patient safety programme pilot included an introduction to patient safety and quality improvement methodology and a briefing on each of the patient safety tools and data collection method in the clinical skills centre. Following this, students were paired up and randomly allocated to attend three out of four SPI data collection sessions on the medical and surgical wards in Ninewells hospital. During this eight week cycle approximately a quarter of the class attended a ward teaching session in Haematology and Cardiology as a compulsory component of the Practice of Medicine programme each afternoon. In weeks seven and eight students participated in the evaluation of the SPI programme. This involved completion of a student evaluation form and also voluntary participation in a focus group discussion. In addition the numbers of completed datasets were recorded

### **3.3.5 Rationale for the study**

During the course of the eight week programme there was a strong negative response from the students' both face to face with the organising team and on the virtual discussion boards. The principal researcher in this study was not directly involved in

the organisation of the programme at that time but had responsibility for the other year 1 activities. As a clinical academic their interest was to identify what had triggered this negative response. The theoretical impetus was one of understanding in order to address the problems identified by the students, and the methods were therefore guided by the theoretical perspective of critical enquiry. The aim of the study was to explore through a qualitative methodology the nature of the negative response and identify what factors influenced the students experiences in the SPI programme.

### **3.4 Methods II**

#### **3.4.1 Justification for methodology**

The purpose of this study was to look at the processes, which influenced the students experiences on the programme. This combined both educational and social systems. A qualitative method enabled understanding of how such systems function in this context. In order to try to determine meaning from any phenomena, which emerged from these data, they needed to be examined in context. A qualitative methodology gave the opportunity to capture the students' interpretations of their experiences in their own words. A purely quantitative questionnaire might have restricted responses and not revealed the phenomena and would have superimposed the hypotheses of the study designers rather than be inductive.

The Framework methodology is an analytical approach, which has been used in the context of applied qualitative research (Ritchie 1994) It was first used by a specialist qualitative research unit whose work covered social and public policy, The Social and Community Planning Research Institute (SCPR). This form of applied research gives

the potential for actionable outcomes which links research through to policy and service development. Hence it was the most appropriate methodology for this research, which intended to use the results to inform future cycles of the programme and to inform how to develop the research as students ascended the curriculum.

### **3.4.2 Focus Groups**

Focus groups were used to collect data from the students. Using focus groups gave the opportunity to look at individual experiences and interactions within the group. In the students clinical activities in the first three years they work mainly with others and using a focus group enabled students to attend with group members. Thus the focus groups gave the opportunity to study interactions amongst the participants, to examine the participants' differences and similarities in their views and experiences of the programme. In a group, participants may feel 'safe', which can allow greater exploration of the issues, and the group allows the individuals taking part some anonymity.

### **3.4.3 Sampling for the focus Groups**

A maximum variety purposive sample of students from the different groups within each year were recruited. Maximum variety purposive sampling is a method which enabled the study to recruit individuals with a wide variety of different characteristics, who would give different perspectives on the study question. The focus groups took place in the evaluation week of the programme and the sampling allowed for groups which had had negative experiences from informal feedback to be mixed with positive. Once participants agreed to take part, the focus groups were

convened and written consent for participation obtained. Participation was anonymous.

#### **3.4.4 Development of a topic guide**

A topic guide for the focus groups was identified through interviews with the academics involved in organising the student participation in data collection for the SPI. (Box 1) The initial part of the guide used questions asking students to describe their experiences on the SPI and this was followed by the students being shown a flow diagram which represented the interviews with the senior academics and asking the students views on this. (Figure 11)

##### **Topic Guide:**

Tell me about your experiences during the SPI?

Tell me about hand hygiene

Tell me about SBAR

Tell me about medicines reconciliation

Tell me about Ask me 3

What did the SPI mean to you in terms of:

1)Your general knowledge of health care

2)Your experience since starting medical school

Are there any specific issues you want to discuss?

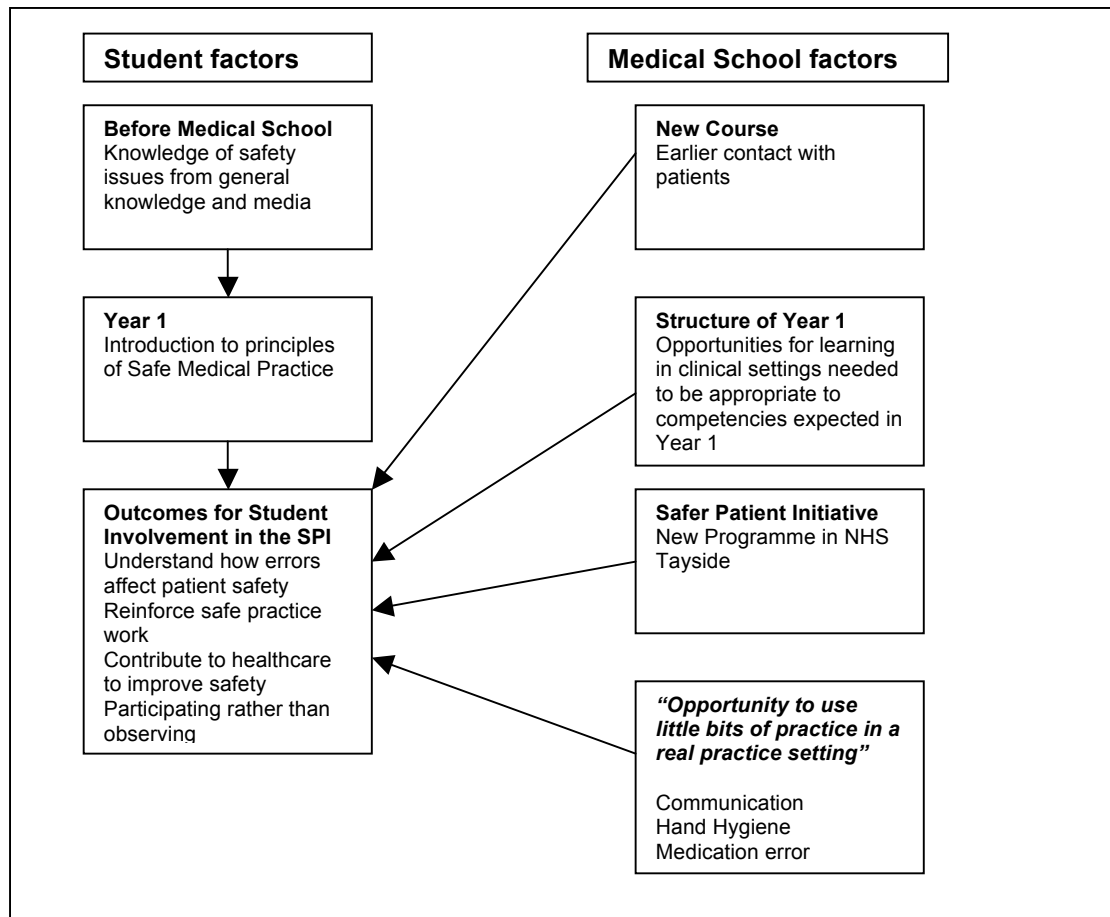
Please look at this diagram which shows how students became involved in the SPI.  
What do you think?

Overall what was your general feeling about being involved in this initiative?

From a learning perspective and from a personal perspective?

Which activities should be included next year for first year students?

#### **Box 1 Focus Group Topic Guide**



**Figure 5**

**Diagram showing the motivation from faculty for student involvement in the SPI**

### 3.4.5 Characteristics of the researcher

As a clinical lecturer in the clinical skills centre, the principal researcher's own role may have affected students recruitment into the groups and their willingness to talk. However in the first cycle of the programme the principal researcher was not actively

involved in the organisation of the programme. The structure of recruitment and the knowledge of anonymity enabled students to speak freely and contribute a large range of views. It appeared that the researcher's role did not unduly influence the content of the focus groups.

### **3.4.6 Analysis**

The analysis was not a distinct part of the research process. Analysis was integral throughout the study, from the initial trigger to the final stages. Here the term is used to discuss the technique used for structuring the analysis of the focus groups.

As described above the Framework analytical process was used in this study (Ritchie 1994). This involved several separate but connected stages. It was not a mechanical process but required a disciplined and structured approach, which then enabled the researcher to determine meaning and connections from the phenomena in these data. Due to time scale of the focus groups the researcher used a combined approach, listening to the tapes with a colleague in the skills centre and making notes between groups. A similar approach has been described by Ashley and Dornan in a study with medical students in ambulatory care settings (Ashley 2008).

There are five key stages involved in the Framework analytical process. These include:

Familiarisation

Identifying a thematic framework

Indexing

Charting

Mapping and interpretation

These will be discussed below:



**a) Familiarisation:**

This step involved gaining an overview of all the recorded data. This involved becoming immersed in these data through listening to the tapes and studying the contemporaneous observational notes. During this stage in the analysis process a list of key ideas and recurrent themes was made.

**b) Identifying a thematic framework**

From the list developed in the familiarisation stage a thematic index was drawn up with which these data was examined and referenced. This index was influenced by the original aims of the study. In this case this was informed by the researcher's prior knowledge from the literature review, her professional interactions with students and her knowledge of educational and patient safety theories and the information from the tapes. This was an intuitive and logical process, which involved much thought and consideration about meaning and the relevance and importance of different issues. Constant reference was made to the question to understand the factors which influenced the students' experiences in the programme and an awareness of the researcher's background and influence over this was acknowledged during the whole study and throughout the analysis.

This framework was refined throughout the analysis process.

**c) Indexing**

Following the initial development of the thematic framework or index, the frameworks were then subsequently applied to these data.

**d) Charting**

Following the application of the framework or index to the individual transcripts, charting occurred. This involved considering each issue and theme in turn and lifting the relevant data from its original place to form a chart.

**e) Mapping and Interpretation**

This part of the process involved the essential features of qualitative analysis. This involved seeking patterns and connections within these data and finding explanations from within these data for these patterns.

This part of the analysis went beyond managing these data and involved a leap of intuition and imagination and was informed by educational theory.

This involved mapping the range and nature of phenomena in the focus groups to examine students' behaviours in the SPI programme. From this associations were found. Following on from this explanations were sought from within these data.

### **3.4.7 Rigour in the research process within the study**

To ensure rigour within the research process several strategies were used.

**i) Clarity of methods and context**

The methodology and the rationale for its use were made explicit at the start of the study with a clear description of the context of the study.

**ii) Sampling**

The sampling process that was carried out is described above. The sample was theoretically informed and relevant to the research question with the intention of reducing bias.

### iii) Validity

To ensure validity ‘triangulation’ strategies were employed. This is where evidence is deliberately sought from separate sources. The quantitative data were used as part of this process.

Dissonant cases, which did not agree with the researcher’s explanation, were also explored. Further measures to ensure validity were regular discussions with a senior colleague. This ensured that no one set of interpretations was allowed to predominate.

### iv) Reliability

In this study it was not possible to have an independent assessment of these data but the researcher had regular supervision. Ideally there would have been an independent assessment.

## **3.4.8 Ethics**

Ethical approval was sought and granted for this study from the University of Dundee Research Ethics Committee.

## **3.4.9 Quantitative Data**

In addition to qualitative data, numbers of successful data sets were collected as a method of triangulation.

### **3.5 Results**

The analysis of the qualitative data is reported below. The number of completed datasets was also recorded and is shown in this section. These data aids in illustrating the analysis of the qualitative data. As indicated above participation was anonymous so demographic data is not available about the sample.

#### **3.5.1 Completed activities – quantitative data**

1. The total amount of datasets collected and submitted by students in relation to each of the 4 tools:

- Ask Me 3: 157 out of a possible 192
- Medicines Reconciliation: 135 out of a possible 192
- Hand Hygiene Audit Tool: 47 out of a possible 183
- SBAR: 73 out of a possible 192

2. The total percentage of fully completed datasets from the potential number of datasets in relation to each of the 4 tools:

- Ask Me 3: 81.7%
- Medicines Reconciliation: 70.3%
- Hand Hygiene Audit Tool: 25.7%
- SBAR: 38.6%

As described in the methodology section the data were analysed using the Framework method developed by the Social and Community Planning Research Institute (Ritchie 1994). This section will present the interpreted emergent themes.

The original question asked about what factors influenced the students experiences on the patient safety programme and from the analysis, interpreted themes have emerged which identified barriers to learning in clinical settings.

### **3.5.2 Challenges for novice learners in clinical settings**

The programme occurred during the students' first semester of clinical contact at a time when the students were in the process of integrating into a learner centred university. In addition to this they had to integrate into a patient centred clinical environment which had different priorities to the university whose main focus is addressing student needs.

The students' opportunities at this early stage in the curriculum to spend time on the wards is limited and so the general experience of ward settings was perceived as a positive outcome by the students:

*"Ask me 3 because that was talking to patients"(1;16)*

*"I got to talk to the nurses and it was really good"(4;11)*

*"Being on the ward and getting to see how things work is a good experience"(4;11)*

In contrast, uncertainty over the students' role in the clinical settings resulted in negative perceptions:

*"I just felt a bit in the way really, I didn't feel I had a place on the ward"(3;6)*

It had been thought that the precise context of the students' patient safety role in the ward setting would simplify the interactions. However the safer patient initiative appeared to add a further dimension to the student and ward staff interactions which increased the complexity of the situation.

*"It was really busy ... (you) just don't want to get in the way. The day that we went onto the ward there was sickness and diarrhoea in the ward and everyone was running about.... they could only give us like three patients .. you just really (felt) quite bad because at the end of the day that is their job "(5;9)*

As mentioned above this was the students' first experience of a clinical setting in the curriculum. Some students had experience of wards from previous work but not as a medical student. As suggested by the quotes, the factors involved in entering a clinical environment as a medical student SPI data collector were complex. Compounding this, each of the activities required different interactions with ward staff. The negative responses described were associated with a lack of previous experience and confidence. Uncertain expectations of clinical settings and varying responses from staff influenced their perception of the value of the educational experience.

*"We were .. just not getting a good response from the staff because we are seen to be in the way rather than helping and like learning"(1;4)*

To complete the patient safety activities, students needed the ward staff or senior students to act either as a facilitators to gain access to a patient and notes or to be observed by the students whilst they collected data for the hand hygiene or SBAR activities. Where students needed the ward staff to act as facilitators to patients or patient notes such as in Ask me 3 or medicines reconciliation, generally successful interactions were described. The students identified these as activities that could be included in future phases of the programme

*“I really enjoyed it because we saw three or four patients and we saw the notes in quite a lot of detail” (6;6)*

*“it’s good for medical students ... it’s good to gets hands on experience, confidence with patients, talking to patients, communication stuff .. even nurses .. approaching them and asking them if they have suitable patients and building, good sort of, relationships between us” (6;12)*

However when the data collection involved only ward staff, and the students were required to observe the staffs’ actions, the students reported less success. The change of dynamic from staff as facilitators to subjects of observation resulted in tensions for the students and a low opinion of their role in collecting data for that activity.

This is demonstrated by the following quote about hand hygiene:

*“I think especially as a first year you feel like you’re an intruder on the ward. Going on to the wards for the first time as a medical student (errm) you’re being expected to observe and by implication criticise what’s going on in the ward. Well, I would have*

*felt perfectly happy following them (ward staff) around going around and seeing the ward, (but) all that ticking boxes saying that you're observing... ”(3;4)*

### **3.5.3 Learning about error – the role of reflection**

Error in many different manifestations appeared to trigger reflection. The tools gave structure to the discussion

The reflections often started with a description of their use of the tool followed by their understanding of the tools

*“Patients we saw .. they tend to be .. on so many drugs.. we saw all the medication they were on and the reasons for it, why they started, stopped, started”(7;9)*

Others were still concerned about the task of completing the paperwork related to the session

*“I think it would be a really good exercise to learn about the drugs, we were so focussed on getting it done that we didn't take it in”(6;9)*

Another student gave the following response which demonstrates when asked to reflect upon the usefulness of tool, the process of reflection identified the purpose as useful when this had not been initially considered.

*“ermm not hugely (useful), it's quite good to consolidate, you know ... what they are on, .. well no (the patient's medication), thinking about it, actually it is quite useful. I didn't put a huge amount of thought into this one, I just filled it out, to be perfectly honest” (4;8)*



For some students using the tools enabled them to consider beyond the initial ward experience to consider what they had learnt. The quote below about medicine reconciliation demonstrates how the use of the tools together with reflection, can facilitate learning about error

*“Going through the drugs. Going through the Kardex (drug chart)... the kardex is quite a flexible document , it’s amended and changed, scored out and.. How accurate was it to begin with? Is everything on there? There’s one or two drugs that the patient’s said to us they were on but when we looked in the Kardex they weren’t and erm there were other times the patient didn’t mention they were on it so oh obviously they were and they didn’t understand why they were on it. Medication starts and stops and sometimes it doesn’t always explain why it starts and stops But for one patient the dose had changed and it looked like it had been discontinued but it was at the end .. there was potential for error there”(7;11)*

Ask me three also provided a similar range of responses from descriptive to reflective. Again the reflective responses provide evidence of learning about safety and error.

*“I learnt myself that there isn’t always good communication on the wards if the patient doesn’t know what’s happening. If I was on the ward ( as a patient) I wouldn’t want to be sitting there thinking.. I think I would like to know. If you had better understanding of your treatment, like, you would be able to comply with it and manage it much better whenever you left (hospital) .. yourself”(7;14)*

Again this student started to consider the meaning of Ask Me 3 when challenged to reflect on it as described above in medicines reconciliation. They started to consider the process and understand how such a process influences patient outcomes

*“Now I was not really sure about this – it is about ‘ what they understand ‘ - it is totally different from what I would understand or what their doctor or their notes would understand so the patient we saw – she realises she has cancer , she doesn’t know the proper terminology for it, which is totally acceptable, and she has a really good simplified version in her head”(5;17)*

An important aspect raised by this student is where there was no error or the processes have all gone well it appears there was no trigger for reflection

*“It does highlight to you that ... you know....I haven’t met someone who doesn’t know what going on with their case really.. erm.. so I don’t know... I suppose I see where they’re coming from.. giving patients power to help in their own recovery”(3;18)*

This final response demonstrates powerfully a number of safety and communication issues. This was a situation that had not been intended to occur for this group. The students appeared to manage it very well with a considerable degree of maturity and was able to reflect upon it to make sense of the issues. They had analysed the problem from both the patient’s perspective and their own and had come up with a way of managing it. This experience may not have been connected to the actual SPI programme but to the clinical placements in either haematology or cardiology, but in the student’s mind they were interconnected with the student using one of the tools

from the programme in a different clinical encounter. Hence the quote describes the transfer of learning from the patient safety programme to other clinical activities.

*“Because a lot of the time perhaps patients find it easier to talk to students than the consultants, like if they have questions we are like less intimidating and we had time. The main time we had an issue....before we went to talk to him .. we’d asked permission obviously and one of the doctors told me that he might have cancer but no one had told him anything yet.. and the whole way through when we were talking to him he kept saying he was worried that he might have cancer..I just felt as if it was really unfair on the patient that I had come onto the ward and I might know something about his diagnosis that he didn’t..... and obviously I would never have like told him anything but I said if he had concerns he should really speak to the consultant about it.. but I just felt as though... that actually... I thought about it a lot. I asked the staff and they were waiting for a specific person to tell him .. so it was fair enough but I just thought he knew he had cancer so the questions ( Ask Me 3) were really useful and helped me to help him ask what was going on ”(7;16)*

### **3.6 Discussion - Data Analysis and interpretation**

This section focuses on the further analysis and interpretation of the two main themes that emerged from the qualitative data from the focus groups. This section will initially discuss the themes in relation to the background literature and following that the themes will be interpreted against educational theory.

#### **3.6.1 Discussion of results in relation to the background literature.**

As described earlier in this chapter, the background literature that informs undergraduate teaching in patient safety is drawn from a wide range of different disciplines within healthcare and has arisen through innovative teaching and the evaluation of this teaching rather than through a programme of specific research.

This means that overall the evidence base is patchy as shown in chapter 2. The evidence does not demonstrate changes in behaviour relating to patient safety teaching interventions. The evidence generally shows links between patient safety teaching in different disciplines and changes in individual skills, knowledge and attitudes.

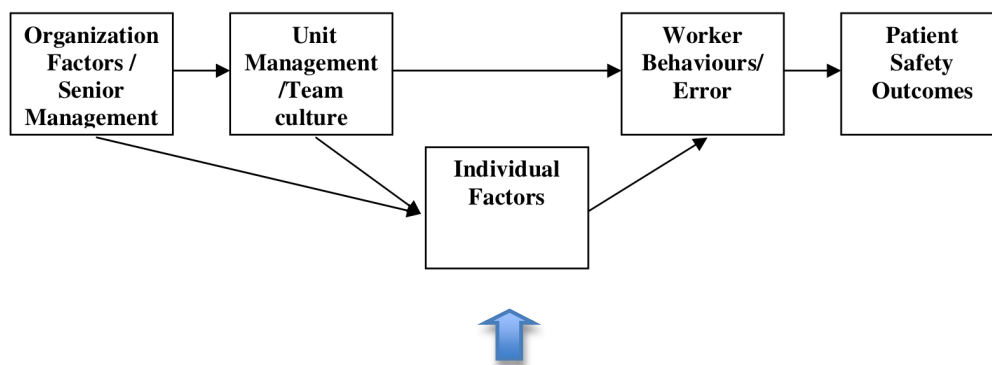
At the time of the pilot study a number of the studies described in chapter 2 had not yet been published and so the evidence base was even more limited than it is currently as was shown in the numbers of papers identified in the first literature search. At the time of the interpretation of the pilot study one of the few papers that has attempted to link educational theory to patient safety had not been published. (de Feijter 2010)

As a result it was difficult to interpret these data with the evidence that was available

in 2007. These data were therefore interpreted using educational theory from a variety of theoretical disciplines.

### 3.6.2 Discussion of results in relation to educational theory

The two main themes that emerged from these data were that of challenges to novice learners in a healthcare environment, in particular the role of intellectual development, and the role of reflection in error and safe behaviour.



**Figure 6 Key factors influencing patient safety: Jackson, Flin 2009**

#### Identification of individual factors from focus group data

Both themes identified related to the individual factors that influenced the students' ability to engage with the patient safety activities. The following sections will discuss the impact of a number of theories and how they might influence learning about patient safety.

### **3.6.3 Individual factors that influence student learning about patient safety.**

#### **a) Challenges to novice learners in clinical settings**

This theme appeared to capture the strong negative response from a subset of students to the programme. This response was an emotional one, which had affected the students and had resulted in difficulties in completing two of the four clinical activities within the patient safety programme.

The students described challenges in going onto the wards. It has been recognised since this programme was initiated that students face a range of challenges in clinical settings. Research by Rees (Rees 2011) has described some of the challenges for medical students in the completion of complex clinical and communication tasks such as intimate examination. The authors describe variable experiences some of which relate to the healthcare setting, others are dependent on the tutors' professional behaviours and some of the variability can be explained by the students' individual characteristics.

In this study these data again showed variable experiences. The Dundee curriculum in the early years has a structure of five core principles, which students need to develop to progress through the curriculum in order to become future doctors. One of these is the principal safe medical practice. This principle relies on developing safe professional behaviours and attitudes, which can be transferred to all clinical settings. This focuses on student themselves and their individual characteristics. Whilst, there is a range of literature, which addresses the healthcare environment, it was decided in

the interpretation at this point to focus on the individual student factors.

**i) Intellectual Development as an individual factor**

The quotes that illustrate the challenges the students faced in healthcare environments are described earlier in this chapter. They show a very personal perspective where students felt that they, as individuals were exposed to vulnerable situations in the wards. Their vulnerability related to the types of interactions they had with staff and the dynamic involved. If the dynamic was such that they were dependent on the ward staff taking on a traditional supportive role, they felt comfortable, but when they were placed in the role of observer, they interpreted this as a judgmental role on behalf of an external adjudicator (the health care organisation), which altered their perceived relationships between themselves and the ward staff. These responses can be interpreted in terms of intellectual development. The theories of intellectual development explore how as individuals mature in their intellectual understanding of their environment they can better understand their experiences. These theories describe the process of maturation from a dualistic or absolute perspective about knowledge, where knowledge is either true or false, to a more mature position where the complexities of knowledge and environment are taken into account before a judgment is made.

Other authors have further developed this work and one author has developed a parallel taxonomy of intellectual development. Baxter Magolda's (Baxter Magolda 1992) work describes four stages of knowing absolute, transitional, independent and contextualised. This aligns well to the students' descriptions of their experiences.

Across the focus group data, negative experiences were interpreted as error on behalf of the University in giving students what the students' felt to be inappropriate activities on the wards. This could be seen as absolute knowing i.e. The university had got it right or wrong from the students perspective. As described earlier in this chapter, these activities were hand hygiene and observation of interprofessional communication using the SBAR tool. Other activities were considered to be more appropriate or correct were those where contact was directly with patients rather than observation of staff.

This interpretation of these data demonstrates Perry's and Baxter Magolda's theories relating to cognitive constructivism and intellectual development (Baxter Magolda 1992, Perry 1999). Individual students' perspectives were linked to experience and understanding of university and clinical environments. Students in the duality stage see themselves as interacting only with the university as a deliverer of their education and as students progress onto the multiplicity stage they begin to comprehend the complexity of the healthcare organisation and in the stage of commitment the student see their role within both organisations and how this fits with the complexities of the patient safety activities. This is equivalent to Baxter Magolda's transitional to independent to contextualised forms of knowing.

This analysis allowed the organising team to understand this aspect of the patient safety programme, which was then addressed in future cycles of the programme. The negative emotional response appeared to link to students in the earlier stages of intellectual development in the context of specific activities. If the students were unable to contextualise the activity the emotional response could be explained and



relates to Bloom's taxonomy of learning in action (Bloom 1956). This describes three domains; cognitive, affective and psychomotor. From these data it can be seen that most of the reports related to the cognitive and affective domains. The discussion above relates to how intellectual development may result in an affective response and how this can have an important impact on student's learning in clinical settings.

**b) The influence of reflection as an individual factor on error.**

The premise of the student patient safety programme was for students to learn and understand about safe practice. However these data very strongly described the influence of error in learning about safety and these data was reflective in nature. This section will discuss error theory and then reflection as a learning process in these data, Following this the section will go on to discuss how reflection appeared to be involved error.

**i) The impact of error**

Human error is the subject of much discussion both at practice level and at theoretical level. This term covers a range of theories, which focus on the individual as being a component of the healthcare process where error can occur. In this section human error will be described in greater detail.

The term error is a contentious one which has a degree of stigma attached to it. It often engenders feelings of frustration, anxiety and stress (GMC 2009). Therefore some authors have moved away from the term human error because of the concern of blame being attached to it. However in describing the development of skills practice, a term is required for when skills are not practised in a manner, which results in the most favorable outcomes for patients. Currently error is the term used in all the literature.

However it does appear from the students' descriptions of their experiences in the clinical areas that they perceived that, during the patient safety activities, they were making judgments about staff behaviours and hence inferring possible error such as in

the hand hygiene audit. This perception was associated with a negative view of the activity overall. It appears that some activities the students perceived the negativity associated with error from some members of the healthcare team was projected onto them as students.

The different models and taxonomies of error are important to consider because they focus on different underlying mechanisms. The field of human error is not discipline bound and much work has arisen from different academic communities including psychology and engineering.

All the error theories start with normal processes and then study where errors can occur. Norman describes seven stages of action model where there is a gulf between the execution of actions and a gulf between the evaluation of actions can occur. In these gulfs errors occur (Rumelhart 1980, Norman 1990). He describes these as slips and mistakes. Mistakes are defined as inappropriate planning and slips are inappropriate execution. Rasmussen (1986) describes a decision ladder that differentiates between skill based behaviour, rule based behaviour and knowledge based behaviour. This is one of the most widely cited frameworks for human reliability. All of these behaviours are cognitive behaviours with varying levels of cognition involved. Skill based behaviour is described as representing sensory motor performance during action that takes place without conscious control. It is a highly automated and integrated pattern of behaviour. In rule based behaviour a sequence of actions is consciously controlled by a stored rule. This requires a higher level of cognition than skill based behaviour. Knowledge based behaviour is the highest level of cognitive involvement. This is used in situations for which the learner has no rules

for control from previous encounters. A goal is required to be developed and plan considered. Their effect is tested against the original goal. This occurs by trial and error and requires the individual to stop and reflect between the original goal and the outcomes of the different plans.

In these data from the pilot study error was described in very general terms and students descriptions did not include any understanding of the frameworks of error. The students had had some introduction but they did not have the language required to analyse and interpret their experiences in terms of the theory. This may have resulted in the emotional response that had occurred with some of the activities. The quotes where students were beginning to understand how error could occur in the workplace appeared to demonstrate reflection. This links to Rasmussen's knowledge-based behaviours where goals or learning outcomes are tested against experience. Again here, reflection appears to be the process that, in both Norman's and Reason's work, moderates understanding of error in clinical behaviours.

## **ii) Reflection as an individual factor**

The concept of reflection is widely considered to have originated from Dewey (Dewey 1933). He defined reflection as an 'active, persistent and careful consideration of any belief or supposed form of knowledge in the light of ground that support it and further conclusion to which it lends'.

A key aspect to the concept of reflection in medical practice is the need to test and revise theoretical knowledge in practice. This is done through process of reflection, action and further reflection. These cycles bridge the gap between theory and practice. In these data it can be seen that there are two distinct reflective cycles noted. One is a

problem-solving approach to an immediate experience or error in practice. These are descriptions of the previous reflective cycle noted by the students. The other reflective cycle identified is where students had completed the clinical activities without stopping to consider their meaning. In these situations frequently the clinical experience had occurred without a perceived error, either patient related or student related, occurring. When asked to consider the activity in the focus group a reflective cycle was triggered.

The work of Schon is relevant to these data (Schon 1983). Schon published a range of work that was based on the number of practice-based professions. The main construction of Schon's theories of reflection was that theoretical knowledge was frequently difficult to access for professionals working with the complex, messy intermediate problems of everyday practice. Schon described two types of reflection; reflection in action and reflection on action. Reflection in action involves three activities which include reframing a problem from different perspectives. This is followed by establishing whether a problem fits into a learned schema and following that, understanding the aspects of the problem, and how they made be resolved and any potential consequences. Reflection on action occurs afterwards and is a process of thinking back on the problem and how it was handled to determine what may have occurred and how an analysis of the situation may influence future behaviour.

Other authors have also identified the importance of reflective learning being linked to experience. (Boud 1985, 2006) and Boyd and Fales (Boyd and Fales 1983) further developed this with their definition introducing the idea that experience is essential for reflection. Boud's work addressed the emotions that might be present both

negative and positive following reflecting on the problem. In this work, Boud linked the final stages of reflection to future behaviour through the identification of outcomes. In these data there is clearly an emotional aspect for the medical students to working with both patients and staff on the wards. These early experiences have the potential to trigger reflective cycles, which may result in changes in professional behaviour.

Moon (Moon 1999) builds on this work to describe reflection as the conduit for moving surface learning to deep learning. The challenge in reflective practice is to demonstrate the influence of reflection on actual medical practice. Two authors have attempted to describe the purpose of reflection, Crandall (Crandall 1993) describes how it appears to occur in response to untested problems and experiences. Palmer identified in nursing students that reflection could be demonstrated in advance of potentially difficult situations (Palmer 1994) . This has resonance to the student patient safety programme.

Alongside this work, Mezirow has developed the theory of transformative learning (Mezirow 2000). It is a complex theory that has arisen from an extensive programme of work over two decades. In transformative learning, an individual develops a new or amended interpretation of the meaning of their experiences, which then guides future action. The process of transformative learning is triggered by a disorientating dilemma which then results through a reflective process in the creation of a new perspective on the situation. Mezirow describes varying types of reflection involved in this. There is content and process reflection where there is an examination of the content of the problem and an examination of the problem-solving strategies that

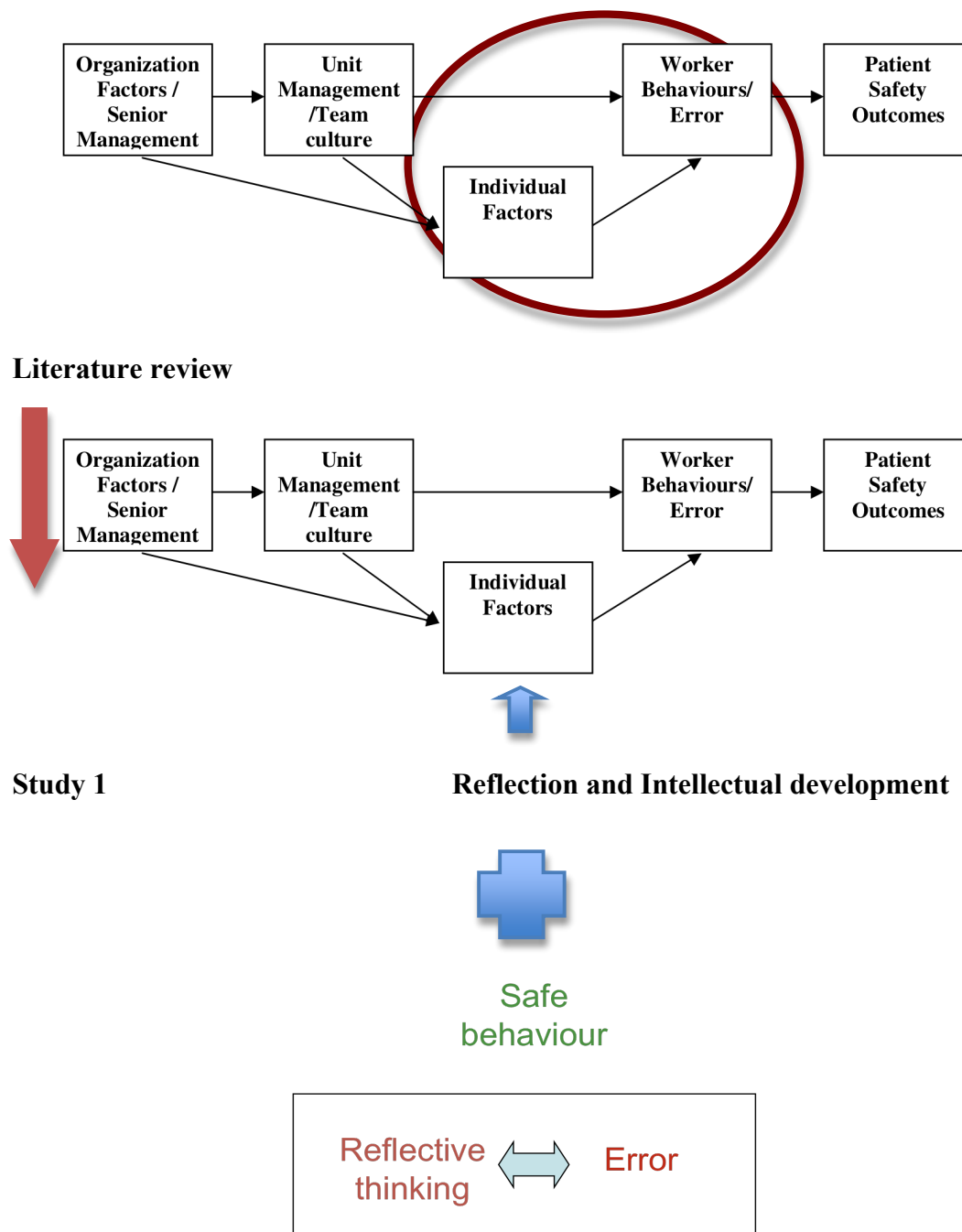
could be used. This leads to premise or critical reflection where the learner questions the problem itself and this level of reflection may lead to a transformation of the learners meaning framework. Mezirow also discusses a different form of reflection called thoughtful action with reflection which occurs concurrently with practice and he distinguishes this from critical reflection which occurs after the event.

Across medical education and education for health professionals it is considered that critical reflection on the premises that learners hold is key to the development as future practitioners. Rational discourse is a fundamental component of transformative learning as described by Mezirow. There needs to be equal participation in discussion and they need to be clear processes within learning group to ensure rational discourse is maintained. Critical self-reflection needs to be achieved through careful facilitation and appropriate challenge to the learners. It is important at this point to identify the types of thinking in Mezirow's model. It is divided into non-reflective thinking, which includes habitual action and thoughtful action without reflection. Then there is reflective thinking, which divides into thoughtful action with reflection and critical reflection. Mezirow's model of transformative learning suggests that critical reflection is required for transformative learning.

### **3.7 The concept of individual factors and error arising from Jackson's model**

The results of the study explore the dynamic between individual factors and worker behaviour and the analysis of the focus group data suggests that two individual factors were relevant for this cohort of students. The two factors were intellectual development and reflection. Figure 13 below shows these results aligned to Jackson's model and demonstrate the progression of the thesis from literature review to study

one to the development of the conceptual model.. Safe behaviour is included but the diagram recognises that this relationship was not clear from these data.



**Figure 7**

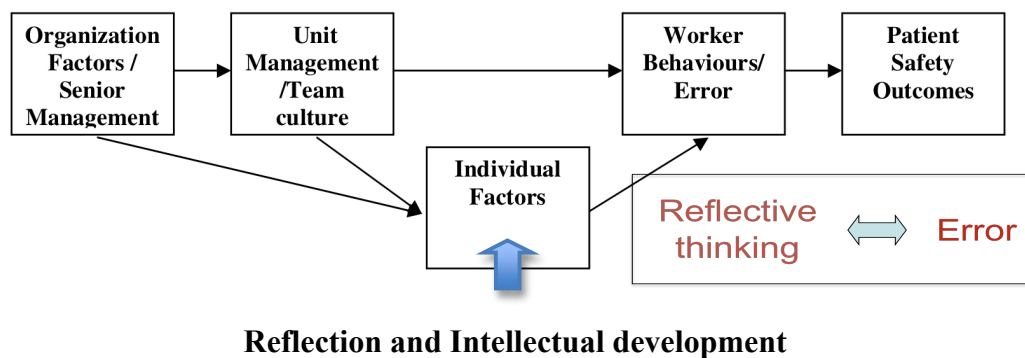
**Key factors influencing patient safety: Jackson, Flin 2009**

**Progression from results of literature search to interpretation of results from study 1 identifying individual factors intellectual development and reflection and error**



### 3.8 Conceptual model

The main concept arising from the analysis was that of individual factors and this was combined with the concept of reflection and error to form the conceptual model shown in figure 14. Reflection in combination with error appeared to relate to the axis between individual factors and worker behaviour and so was placed alongside this axis in the diagram.



**Figure 8**

### Combining the concepts to form a conceptual model

**Key factors influencing patient safety: Jackson, Flin 2009 and Individual factors and a conceptual model of error and reflection**

### 3.9 Summary

The pilot study started with a negative response to a newly introduced programme. The analysis identified two main themes, which were interpreted with educational theory. These themes identified two factors; intellectual development and reflective ability as being related to the students learning within the patient safety programme. These fit with individual factors within Jackson's model (Jackson 2009). Alongside this, reflection appeared to be associated with error and this appeared to relate to the dynamic between individual factors and worker behaviour.

## **Chapter 4**

### **Theoretical, methodological and contextual influences**

#### **4.1 Overview of chapter**

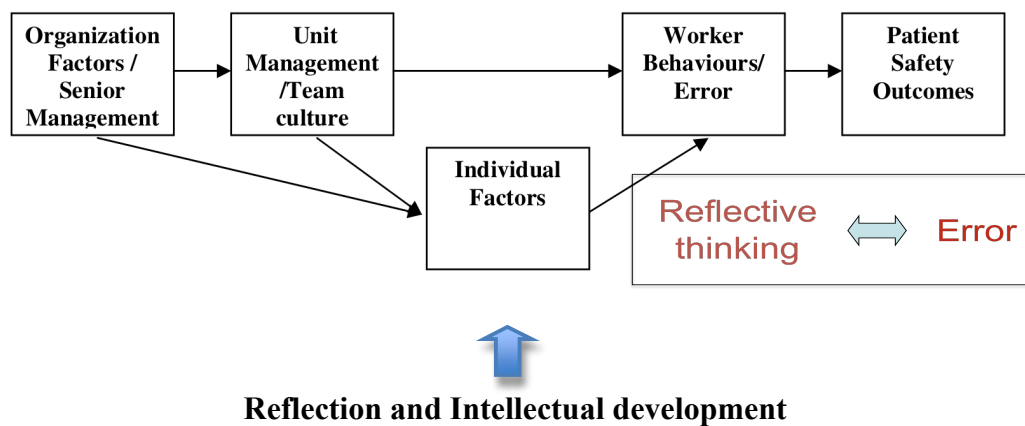
This chapter addresses the theoretical, methodological and contextual issues that were considered in order to explore the interpretation of the pilot study. This chapter initially focuses on understanding the concepts that arose from the pilot study and how these formed the conceptual model. Subsequent to this the chapter identifies the methodological approaches required to test the conceptual model.

#### **4.2 Identifying the theoretical perspective required to explore the conceptual model from the pilot study**

These data presented in chapter 3 and their interpretation represent the epistemology of constructionism where experience is based upon the interactions of human beings (Crotty 1998). This can then be explored in terms of theoretical perspectives, which then indicates the appropriate methods to apply to the research questions.

In the setting of these studies the intention was to enquire to bring about future change rather than purely to understand. Therefore the theoretical perspective that informs these studies is that of critical enquiry, where the underlying purpose is to enhance teaching and learning about patient safety through greater understanding of the individual factors that influence patient safety (Crotty 1998).

The student patient safety programme was established to form the foundations of safe practice but it appears from the interpretation that individual factors influenced students' perceptions of the patient safety activities. The factors identified were intellectual development and reflection. Intellectual development appeared to solely work as an individual factor whilst reflection appeared to influence the dynamic between behaviour and the individual, in particular error behaviour. These potential associations had been derived from students' reactions and perceptions. The next step in critical enquiry, following on from the pilot study, was to identify if the individual factors could be tested at the next step in Kirkpatrick's hierarchy, that of knowledge and attitudes. If this association could be tested and demonstrated at Kirkpatrick level two, it would then enable further exploration of the role of error in reflection



**Figure 8**

**Key factors influencing patient safety: Jackson, Flin 2009**

**Individual factors and a conceptual model of error and reflection**

Following consideration of the theoretical perspectives discussed, the following questions emerged:

#### **4.3 Questions arising from the pilot study**

The main question that arose from the pilot study addressed individual factors. The second question addresses error and reflection.

1. Are reflection and intellectual development relevant individual factors when learning about patient safety?
2. Is there an association between reflective thinking and error at different levels in Kirkpatrick's framework?

#### **4.4 Identifying the methodological approaches required to develop and test the conceptual model from the pilot study**

The pilot study was initiated as a piece of action research. Whilst this a recognised methodological approach within critical enquiry, it was felt that is may not be sufficient to address the research questions identified from the pilot study after considering the epistemology and theoretical perspectives.

Action research is a method of progressive problem solving through a reflective process. As described in the pilot study, the first cycle of the patient safety programme had raised a number of problems. The intention of the principal researcher was to initiate a process of enquiry and discussion about the medical student patient safety programme. Action research follows the cycle of identification of the problem, collection and organisation of data, interpretation of data, action based on the data and reflection.

As discussed above the interpretation of the error and reflection theme revealed a more theory-led direction of enquiry. The theme of error and reflection, and the questions that arose from it, sought to identify why the students behaved as they did in addition to how to do things better for the following cycle. These questions, as shown above, go further than the purpose of action research. Therefore, the principal researcher needed to look beyond action research to understand how to approach these questions. The following methodological approaches were considered to answer the questions.

#### **4.5 Evaluating a complex education intervention**

Three main methodological influences will be discussed in this chapter. The first is the guidance from the Medical Research Council about the development and evaluation of complex interventions (Craig 2008). The reason for using this guidance is that complex interventions in medical care have a number of similarities to educational interventions. In the guidance, a complex intervention is identified by a number of criteria. These include:

- A number of interacting components within the intervention.
- The number and level of difficulty of the behaviours required by those delivering or receiving intervention.
- The number of groups targeted by the intervention.
- The number and variability of outcomes
- The degree of flexibility of tailoring of the intervention that is permitted.

Few educational interventions can be considered as simple, and patient safety involves multiple educational outcomes as well as a number of complex behaviours as shown in chapter one. As can be seen from the interpretation of the focus group data there appeared to be a number of interacting components including the individual factors intellectual development and reflection which resulted in the research questions at the start of this chapter. The MRC guidance could be used as an approach to these questions.

The guidance, as well as identifying the defining criteria of complex interventions, also identifies a series of key elements in the development and evaluation process for

a complex intervention. The guidance identifies four stages; those of development, feasibility and piloting, evaluation and implementation.

The development element appeared to be most applicable to the pilot programme. The development stage has three main steps within it. The first step is identifying existing evidence. This involves searching and reviewing the literature to identify what is already known about the proposed area of work and also identifying how existing work was evaluated. The ideal way to do this is via a rigorous systematic review of the evidence. Any systematic review requires to be continually updated. At the onset of the student patient safety programme an initial literature search had been carried out. It can be seen from the current literature review described in chapter 2, in 2006-2007, there was relatively little published research about how to introduce patient safety teaching to medical students. The work that was available was predominantly with students higher up in the curriculum. The process of identifying existing evidence has continued throughout the thesis and the literature review presented in chapter 2 contains the most recent work in this area.

The next step in the development stage is identifying and developing theory. The MRC framework stresses the need to develop a "theoretical understanding of the likely process of change by drawing on existing evidence and theory" (Craig 2008 p.981). Chapter 4 describes part of the process of this step within this series of studies. The analysis and interpretation of the qualitative data from focus groups identified a series of potential theoretical perspectives on individual factors that influence the process of learning about patient safety. The process of using the primary research from the pilot interpreted with educational theory fits with this step

in the framework.

The third step the development stage of the MRC framework is the modelling process and outcomes step. This step can give relevant information about how to approach the design and evaluation of an intervention. In Craig's paper (Craig 2008) he describes that a series of studies may be required to progressively refine the design of an evaluation before a full-scale evaluation can be achieved. This series of studies represent modelling.

#### **4.6 Types of measurable outcome and Kirkpatrick's framework**

For complex patient safety interventions, the types of outcomes that are used in clinical practice relate to patients. For example, a reduction in the wound infection rate in patients undergoing surgery, following the introduction of an improvement programme. In education, in particular medical education, these types of outcomes are very difficult to achieve. Students do not often impact directly on processes of care, or on patient outcomes. Therefore, to look at the effect of an educational intervention other types of outcome measures need to be used. This involves considering other steps in Jackson's model that can be measured (Jackson 2009).

In studies presented here, this part of the MRC framework was used to identify how to test the hypothesis that there is an association between the individual factors of intellectual development and reflection and the patient safety constructs of error and safe behaviour. These concepts were based upon data from focus groups interpreted with both educational and patient safety theory. This step in the MRC framework involved considering what outcomes could be used to answer the research questions



and to explore the conceptual model identified in the pilot study.

Kirkpatrick's framework outlines a series of levels (Kirkpatrick 2008). Barr has described an adaptation for the evaluation of health professional education (Barr 2000). This was previously described in chapter 2 in relation to the literature review. It is a framework, which has been described to identify the types of outcomes that can be used to evaluate educational interventions:

Level 1: Participation—covers learners' views on the learning experience, its organisation, presentation, content, teaching methods, and aspects of the instructional organisation, materials, and quality of instruction

Level 2a: Modification of attitudes or perceptions—outcomes here relate to changes in the reciprocal attitudes or perceptions between participant groups towards intervention or simulation

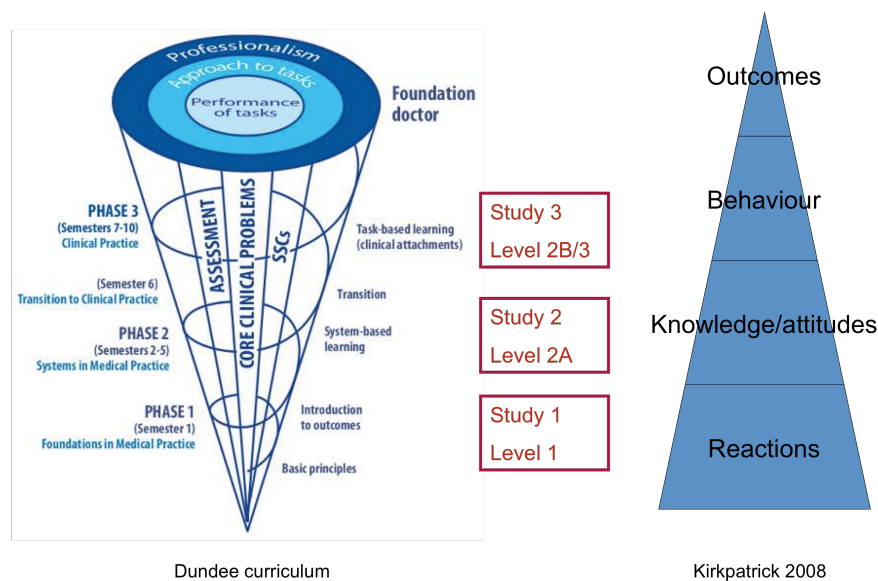
Level 2b: Modification of knowledge and skills—for knowledge, this relates to the acquisition of concepts, procedures, and principles; for skills this relates to the acquisition of thinking and problem solving, psychomotor and social skills

Level 3: Behavioural change—documents the transfer of learning to the workplace or willingness of learners to apply new knowledge and skills

Level 4a: Change in organisational practice—wider changes in the organisation or delivery of care, attributable to an educational programme

The interpretation of the results from the focus groups, presented and discussed in chapter 3, represents students' perceptions. It can be seen from Craig's work that healthcare interventions are at level 4. This raised a problem in terms of translating the results from the focus group into further work. This mirrors the gaps in the

literature identified in chapters one and two and the issues of identifying patient safety measures for medical students. It was decided at this point that the possible associations identified from the focus groups should be tested at higher levels in Kirkpatrick's hierarchy, in order to test these further and to identify both the types of educational setting that could be used and the types of outcome measure that could be applied. Therefore, as this cohort of students ascended the curriculum, different studies were used to test the model at different levels in Kirkpatrick's hierarchy. A diagrammatic version is shown below in figure 16.

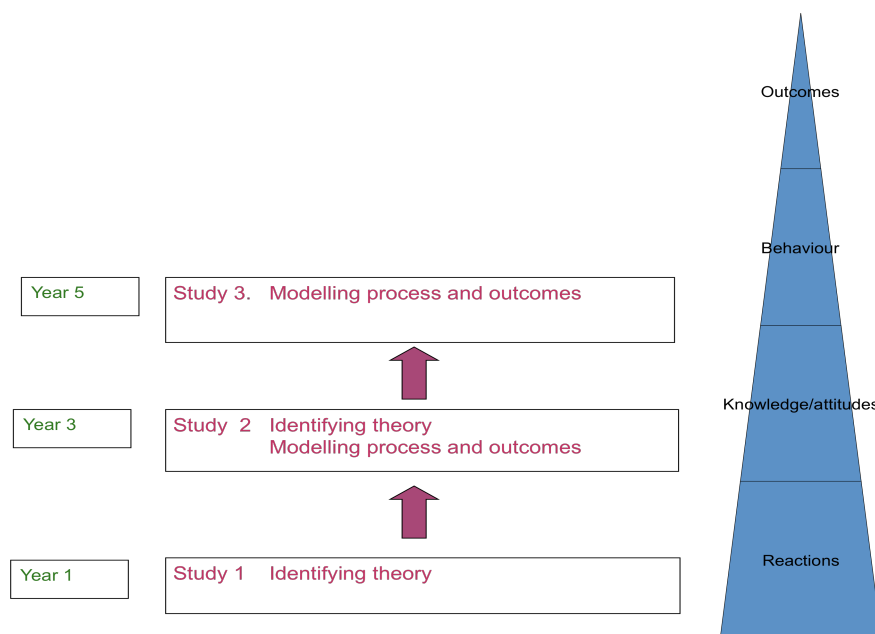


### Figure 9

## Overview of the studies aligned to the spiral curriculum and Kirkpatrick

A cyclical process was used to test the interpretation of the focus group data from study one. The questions were constructed to test the concepts at Level 2 in Kirkpatrick's framework i.e. knowledge and attitudes in year three of the Dundee curriculum and then when the students were in year 5 to test the concepts to level 3 in Kirkpatrick's hierarchy i.e. behaviour.

By completing studies up to the behavioural level a conceptual model of the individual factors that influence student learning about patient safety could then be described. The process completed in this thesis might inform where an intervention could be located in a curriculum and how its impact could be measured. In order to do this the potential associations needed to be tested in a rigorous manner. These studies were aligned to the second two steps in the development stage of the MRC framework, those of identifying and developing theory and modelling process and outcomes. This is shown in the figure below:



**Figure 10**

### **Combination of the MRC Framework with Kirkpatrick**

#### **4.7 Design Based Research**

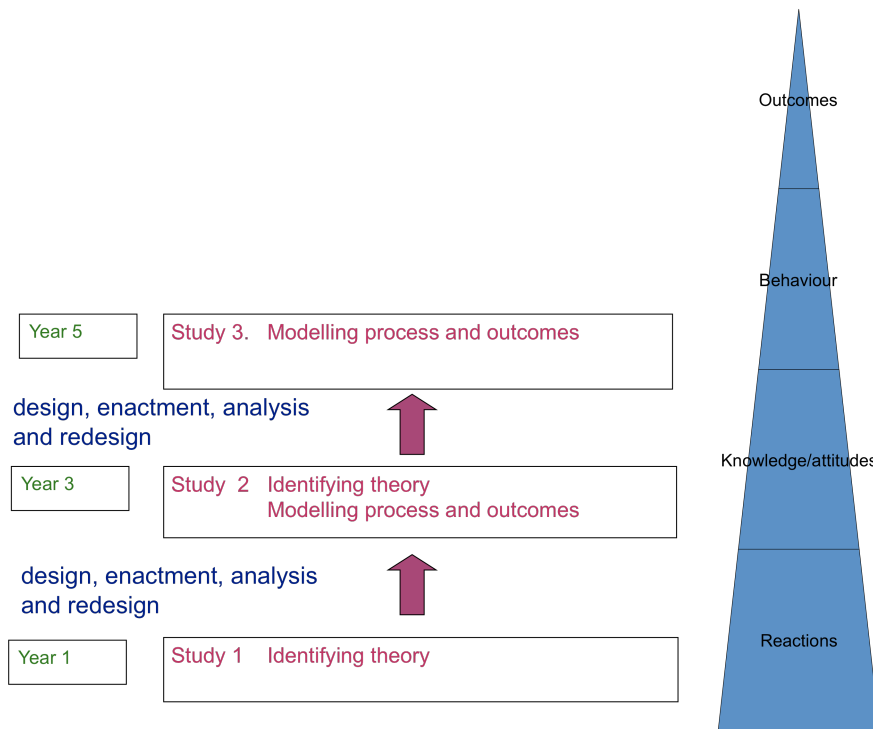
In addition to the MRC framework and Kirkpatrick's hierarchy a third methodological influence was used. At the beginning of this chapter it was discussed that action

research was not applicable to this route of enquiry. Design based research has been described in medical educational research and offers an alternative framework to use here (Design based research collaborative 2003). This paradigm for educational enquiry blends empirical educational research with theory driven design. This combination appeared to offer a further framework to inform the cyclical nature of studies presented here.

The Framework methodology (Ritchie 1994) used in the pilot study has also been used to inform policy to allow changes in practice. The purpose of the Framework methodology is to achieve this by examining qualitative data using four categories; contextual, diagnostic, evaluative and strategic. In the pilot study the themes link strongly to the contextual and diagnostic categories. Design-based research has been developed with a similar philosophy but with the intention of linking theory to practice (Design-Based Research Collective 2003). It has been applied within medical education (Dornan 2008). Design-based research promotes the use of theory driven design to create and evaluate complex educational interventions.

In these studies, the ‘policy’ described in the Framework methodology and educational theory of design-based research can be considered as the drivers of the educational intervention. The intervention can then be improved through empirical study, which then enhances the understanding of the underlying theory. These objectives are not easily realised. The triad of objectivity, reliability and validity are described as being necessary to introduce scientific rigour into design-based research. However the authors that promote design-based research recognise that this triad may be used in different ways than seen in traditional research. In the promotion of

objectivity a tension is created in the researcher or research team between being advocates for the intervention and critics of the process. In these roles, triangulation methods are required to connect intended and unintended outcomes to processes of enactment, hence introducing rigour. Those advocating design-based research suggest that methods that document processes of enactment provide critical evidence to identify why certain outcomes occur (Design based research collaborative 2003). This approach resonated with the theoretical perspective of critical enquiry, which underpins the studies described in this thesis. In particular, the suggestion that design-based research may offer a way of developing contextualised theories of learning and teaching is directly relevant to patient safety. Design-based research has a set of central constructs that can be applied to these studies. They include the principle that the central goals of designing learning environments and developing learning theories or 'prototheories' are intertwined. Additionally, development and research take place through continuous cycles of design, enactment, analysis and redesign. Finally, these processes rely on methods that can document and connect processes of enactment outcomes of interest. This relates back to Kirkpatrick and to the MRC framework for the evaluation of complex interventions. The diagram below (figure 18) represents how these three methodological influences were brought together in the studies.



**Figure 11**

**Methodological combinations of MRC Framework, Kirkpatrick and Design based research used in the studies.**

#### **4.8 Evaluation vs. Research**

In the methods described above there is a lack of clarity about the differences in the terms evaluation and research. There are distinct differences, which have been described (Morrison 2003). Evaluation is an essential part of medical education and is generally used for local quality improvement of an educational programme. As such, Kirkpatrick's levels can be used to demonstrate the impact of the educational intervention at the levels listed above.

However when enquiry is intended to produce results that are generalisable, and can be disseminated in the peer-reviewed literature, this purpose of internal quality improvement changes from evaluation and enters the domain of research. This situation requires greater safeguards such as ethical consideration of the proposed study.

Evaluation is a continuous improvement process that intends to improve courses, whilst research, although similar, may stop if an answer is found. The term evaluation is used widely in health services research, as described in the MRC paper by Craig (Craig 2008). The purpose of the work they describe fit with research and the mixed use of terminology can lead to confusion and overlap between the terms. The purpose of these studies fit with research rather than evaluation.

#### **4.9 Objectivity, validity and reliability**

As described above there is an essential triad of objectivity, validity and reliability, which are central to making design-based research a scientifically sound process. The next section discusses how these three constructs were applied to this thesis.

Objectivity is a term, which in its purest meaning indicates that there is a 'truth' that can be identified, which exists outside of an investigation or observation. It might be considered that the researcher's role is to reveal this 'truth' without contaminating it. However, this concept is now widely rejected in favour of a more realistic aim, which is that the researcher should use processes, which enable them to be impartial to the outcome of the research and to acknowledge their own influence and bias in order to moderate its effect. In these studies, the researcher put in place processes in the pilot study to promote objectivity and in subsequent studies this was acknowledged within

the researcher's approach to each study. The use of triangulation data within the pilot study facilitated objectivity. In the subsequent studies the role of other recent research in the area was identified as a method of facilitating objectivity. This process involved considering the results of other studies and work in this area, using it for triangulation purposes.

Validity is the second term in the triad and this refers to how well a scientific test or individual research actually measures what it intended to, or how well it represents the 'reality' it is intended to. Validity is founded the positivist scientific tradition which asks, "Are we right"? The term validity represents a body of research that demonstrates the relationship between the test used in the research and the knowledge, attitude or behaviour it is intended to measure. In the literature several different types of validity are described which relate to the content of a test, the criterion within the test and how effectively the test is in predicting the indicators of the construct. The final form of validity described is construct validity, which is demonstrated if the test shows an association between the scores within the test and the prediction of the theoretical trait. In the studies described in the following studies the questionnaires and assessment tools used had been either validated and published within the peer reviewed literature or had not yet been published at the time of first use in this thesis, but gone through a rigorous validation process.

Reliability is the third term within the triad and this is the consistency of the measurements or the degree to which the test measures the same way each time it is used under the same conditions with the same subjects. Common approaches to reliability are tests of internal consistency. Internal consistency estimates reliability by



grouping questions in the questionnaire that measure the same concept. This method involves only one administration of a test.

Medical education has used internal consistency as a method of looking at reliability of tests in various settings. This approach has been used in assessment and research, using Cronbach's alpha, and other reliability coefficients.

These reliability coefficients provide an index of measurement of consistency which ranges from 0-1.00, which represent the underlying premise that the observed score can be differentiated into a true score and a single undifferentiated random error term. Coefficients with values which are higher and closer to 1 are thought to be more reliable. This is achieved via calculations derived from the relationships amongst test items. This is based on the co-variation amongst items internal to the test. However classical test theory's reliability coefficients such as Cronbach's alpha have limitations. In classical test theory's reliability coefficients, the sources of measurement error are left undifferentiated. In a self-administered test such as self-reported questionnaire it may be acceptable to leave this measurement error undifferentiated. Cronbach's alpha can give acceptable information about the reliability of self-administered questionnaires. However, if behaviour is being measured through external judgment this introduces further sources of measurement error. Therefore when establishing the reliability of measures of behaviour a different form of reliability coefficient needs to be considered.

Generalisability theory is a statistical theory for evaluating the reliability of behavioural measurements (Brennan 2001). It has been developed and introduced to

address the sources of measurement error that were not addressed through classical test theory. In generalisability theory, behavioural measurement is conceptualised as a sample from a universe of admissible observations where there are multiple potential sources of error, which are called facets of the measurement. Generalisability theory involves two types of study, a generalisability study and a decision study. The generalisability study is designed to isolate and estimate as many facets of measurement error as is feasible and the decision study deals with the practical application of the measurement procedure, where a decision about behaviour could be norm referenced (relative) or criterion referenced (absolute). Error variance is defined differently for each kind of decision. Generalisability or G theory is in essence a random effects theory. As in Classical test theory a coefficient is calculated but there are additional measures, which give further information.

Returning to the triad of objectivity, validity and reliability, it can be seen that these all impact on the design of the studies developed to answer the questions posed at the beginning of this chapter.

When considering how to answer these questions at different levels of Kirkpatrick hierarchy, multiple approaches to validity and reliability needed to be considered. Different methods of assessing reliability need to be used when looking at self completed questionnaires or when considering external judgments on behaviour. Therefore different methods to measure reliability would need to be used depending on the outcome being tested. In particular when considering error and safe behaviour at behavioural level, identifying methods for looking at the reliability of judgments would be essential where expert opinion was used to make judgments about error and

safe behaviour.

#### **4.10 Testing associations**

After considering the concepts of validity and reliability in terms of the outcome measures required to test reflection and intellectual development at level 2, the next step required to answer the subsequent research questions about the conceptual model, was to identify any associations between the individual factors and components within Jackson's model.

The interpretation of the pilot study results suggested two individual factors reflection and intellectual development. This opens a further area of methodology, that of the relation between two continuous variables. This group of statistical tests looks at the relation between variables in terms of association, prediction and agreement (Altman 1991)

Association is the first step in examining a relationship between two continuous variables. Association examines via biostatistical testing, if the values of one variable tend to be higher, or lower, for higher or lower values of the other variable. The second step, which is prediction, examines whether the value of one variable can be predicted from any known value of the other variable. The third step, which is agreement, assesses the amount of agreement between the values of the two variables. This situation most commonly arises in the comparison of alternative ways of measuring or assessing the same thing (Altman 1991).

In order to test the conceptual model described in chapter 3, tests of association were

required. The method used to identify associations between continuous variables is called correlation.

In order to examine any association further the degree of association is measured. Calculating the correlation coefficient does this. One of the most frequently used methods, attributed to Pearson results in the value called  $r$ , which measures the degree of the straight line association between two variables. A value of -1.0 to + 1.0 is obtained. If the value is close to +1.0 or - 1.0 it suggests that the values lie on a perfect straight line and there is a very strong association. If the value is zero then it suggests there is no linear relation between the values. To calculate the correlation coefficient there are some restrictions on the validity of the associated hypothesis test. These require that the data on at least one of the variables has a normal distribution in the population. Following the calculation of the correlation coefficient a confidence interval can be calculated and then a hypothesis test can additionally be calculated.

There is much discussion about the use and misuse of correlation as a method of testing for association. In addition to the distributional assumptions discussed above, a further restriction is that the observations need to be independent. This means that only one observation of each variable should come from each individual in the study. The other problem with correlation is that in studies where large numbers of variables have been recorded, it is possible to calculate hundreds correlation coefficients and then pick out the ones which have shown statistical significance. This is a term known as data dredging. In this situation, there is a risk that over interpretation may occur.

In this thesis, the intended use of correlation was to test specific relationships in terms

of two levels of reflection identified Mezirow's model, intellectual development and measures of safe behaviour and error. Additionally, in light of the discussions about validity and reliability above, only continuous variables that met agreed levels in terms of reliability would be tested for association. Hence the number of variables tested would be limited.

The process of ensuring that only validated tools were used to measure the variables, and only testing variables where the tests of reliability had reached acceptable levels were intended to introduce rigour to the studies. The process by which this was done for studies two and three is described in detail in chapters 5 and 6.

#### **4.11 Summary**

This chapter explains how the interpretation of the pilot study and the questions that arose from the interpretation were considered in terms of theoretical perspectives and research methods. This was done through the identification of an epistemological position and the subsequent identification of a theoretical perspective and appropriate methodologies that could be applied to the research questions.

The overlap between health services research and medical educational research emerged from the Framework methodology and the MRC framework for the evaluation of complex interventions. These provided a partial methodological solution. This combined with a Kirkpatrick used as a structure to consider outcomes for medical students help to clarify the methods that could be applied. These methods required a rigorous process and the importance of the triad of objectivity; validity and reliability, identified in design-based research, gave an explicit description of what is

frequently an implicit process in research.

The following chapters describe the succeeding studies, which were the synthesis and application of the theoretical perspectives and methods in practice, to develop and test the conceptual model at different levels in Kirkpatrick hierarchy.

## **Chapter 5**

### **Study 2**

#### **Testing of individual factors and the conceptual model at Kirkpatrick level 2**

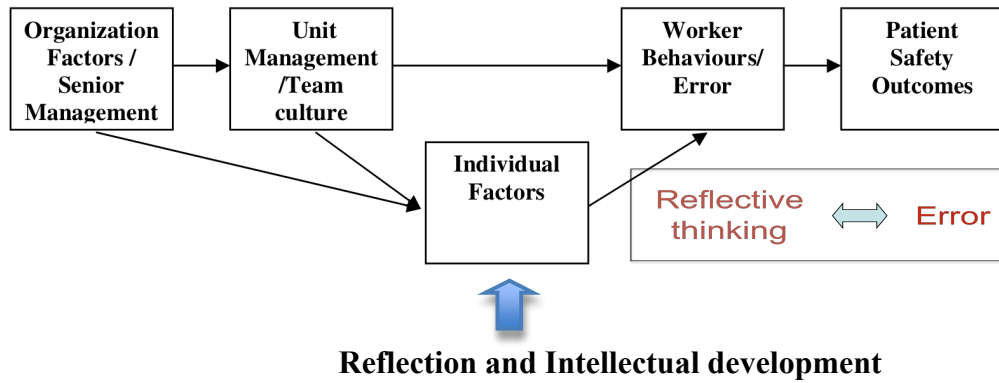
##### **5.1 Overview of chapter**

This chapter reports the second study in this thesis. This uses the methods that were derived from the theoretical perspective of critical enquiry. The methods were used to test the interpretation of the pilot study and the conceptual model discussed in chapters 3 and 4.

##### **5.2 Introduction**

The pilot study, described in chapter 3, reported the students' reactions to the introduction of patient safety activities to the medical curriculum. The analysis of the focus group data identified the potential dynamic between individual factors and error behaviours. The two individual factors that were identified were intellectual development and reflection. Reflection appeared to affect the dynamic between understanding of worker behaviour and error whilst the connection between intellectual development and patient safety was less clear from these data.

The initial programme had intended to introduce safe behaviours into the curriculum. The data from study 1 had not overtly included safe behaviour, but it had not conclusively excluded it and so safe behaviour was kept in the hypothesis under the overarching title of patient safety for this study, whilst accepting that study one's results had focussed on error behaviours.



**Figure 8**

**Key factors influencing patient safety: Jackson, Flin 2009**

**Individual factors and a conceptual model of error and reflection**

### 5.2.1 Hypothesis

The hypothesis of this study is that there is an association between the individual factors intellectual development and reflection and understanding of patient safety.

### 5.2.2 Aims

Therefore this study aimed to:

- Identify measures of reflective thinking, intellectual development, and attitudes and understanding of error and safe behaviour in medical students
- Evaluate the reliability of these measures in this cohort of students
- Determine if an association exists between intellectual development and attitudes and understanding of error and safe behaviour in medical students.
- Determine if an association exists between reflection, and attitudes and understanding of error and safety in medical students.



## **5.3 Methods**

### **5.3.1 Study Design**

There were no studies in the literature, which had established a link between intellectual development, reflection and patient safety. Therefore this second study was initiated with the aim of exploring the proposed associations between these factors in the same cohort of students at Kirkpatrick's level 2; that of knowledge and attitudes when they were in the third year of the Dundee MBChB course.

The objectives included establishing the validity of the measures of knowledge and attitudes to patient safety, intellectual development and reflection in third year medical students and identifying if associations exist between measures of reflective thinking, intellectual development and understanding and attitudes towards patient safety and error.

In order to answer this question the triad described in chapter 4 of objectivity, validity and reliability was considered in terms of reflective thinking, error and safe behaviour. Each of these needed to be measured in a valid and reliable manner before any associations could be tested.

### **5.3.2 Questionnaire identification**

Chapter 2, identified studies from the literature, which were reliable measures of knowledge and attitudes regarding patient safety. Until 2007, the only questionnaires available to test this had been developed for postgraduate use. The measures available had not been validated with junior medical students. A study in 2007 (Patey 2007) used a questionnaire, which tested knowledge and attitudes towards error and patient

safety with final year medical students. This questionnaire covered the range of subjects, which were appropriate for undergraduate medical students. The questionnaire covered two main areas. The first section contained questions about general knowledge and feelings relating to patient safety and what action should be taken if an error occurred. This section contained questions, which were designed from Azjen's theory of planned behaviour, which is a theory that proposes that individuals' intentions to behave in a certain way can be predicted from attitudes towards the behaviours, their perceived behavioural control and subjective norms (Azjen 1991). Patey and Flin designed a questionnaire in which these constructs were measured in relation to patient safety. The areas covered included personal attitudes, safety in the workplace personal influence with regard to patient safety and future intentions towards patient safety. In Patey's 2007 (Patey 2007) publication there is no discussion of the evaluation of the questionnaire.

The individual factors that had been identified were reflective ability and intellectual development.

A diagnostic tool needed to be identified, which could test reflective ability in medical students. A further literature search at this point in the studies, revealed a limited number of studies whose methods could be used in this setting. The literature identified four studies (Kember 2000, Grant, 2002, Boenink 2004, Aukes 2007), three of these were self-administered questionnaires was the fourth used vignettes to identify reflective ability.

Reviewing the three self-administered questionnaires, demonstrated that they covered

a large number of areas under the heading of reflection. The Groningen Reflection Ability Scale (GRAS) developed by Aukes (Aukes 2007), had three identified factors within it, which included self-reflection, empathic reflection and reflective communication. Self Reflection and Insight Scale (SRIS) developed by Grant (Grant 2002) used theories of metacognition and self-regulation to measure readiness of individuals for purposeful behavioural change. The third, developed by Kember (Kember 2000) is a diagnostic questionnaire based on Mezirow's models of reflection and transformative learning (Mezirow 2000). The questionnaires had all been evaluated using Cronbach alpha to test internal consistency and factor analysis had been used in the evaluation of all three questionnaires. Kember's questionnaire had been developed for use with a group of students from different healthcare professions. This, together with its basis in Mezirow's model and its published reliability data made it the most appropriate choice of questionnaire to be used in study two.

The other individual factor was that of intellectual development. A number of approaches have been described to measure this attribute. However these were assessed through specific pieces of writing about subjects, which were then graded through a group in the USA (Perry 1999). Given that the data from the focus groups was placed in the context of a Medical School, it was felt that a questionnaire needed to be identified which would allow for interpretation by the principal researcher who could interpret data in the context of the undergraduate curriculum. A further questionnaire was identified, the measure of epistemological reflection (Baxter Magolda 2002). The measure had previously been used with dental students but there was no reliability data available.

### 5.3.3 Questionnaire structure

The patient safety and reflection questionnaires used item scales with response options ranging from strongly agree (5) to strongly disagree (1).

The Kember reflection questionnaire identifies four areas. A series of four items are included relating to following aspects of Mezirow's model (Mezirow 2000):

- Habitual action
- Understanding
- Reflection
- Critical reflection.

The patient safety questionnaire has six sections, which cover both general knowledge and feeling and the theory of planned behaviour (Flin 2009). At the time this questionnaire was used the authors had developed a questionnaire for junior medical students, which was undergoing evaluation. The team were contacted and with their agreement the adapted version of the questionnaire was used in this study. The questionnaire consisted of five or six item scales again with response options ranging from strongly agree (5) to strongly disagree (1).

#### *General knowledge and feelings*

- Level of Knowledge
- Knowledge of actions to take
- Feelings about error (2 sections)

#### *Theory of planned behaviour*

- Personal attitudes
- Safety in the workplace

- Personal influence
- Future intentions

The Measure of Epistemological Reflection (intellectual development) asked the students to write responses to questions about recognised challenges in undergraduate studies (Baxter Magolda 2002). The questionnaire is included in Appendix 2. It is graded on a four-point scale, absolute knowing, transitional knowing, independent knowing and contextualised knowing.

#### **5.3.4 Ethics**

Ethical approval for the study was granted from the University of Dundee Research Ethics Committee.

#### **5.3.5 Sample**

Following discussion with the ethics committee all third year students were invited to participate in the study. They were invited to participate via e-mail and information was posted on the virtual learning environment. Participants then contacted and attended the clinical education centre where they were consented and were given the forms to complete.

#### **5.3.6 Statistical analysis**

The statistical analysis fell into two sections. Firstly establishing the reliability of the questionnaires and whether they demonstrated sufficient internal consistency for any further analysis of these data to be considered valid. The further analysis involved the

calculation of correlation coefficients. All calculations were performed using Microsoft Excel.

### **5.3.7 Reliability**

The reliability of the questionnaires was assessed using Cronbach Alpha. If the questionnaire reached acceptable levels of internal consistency then tests of association would be carried out. It was not possible to establish reliability of the Measure of Epistemological Reflection (Intellectual development) using Cronbach alpha.

### **5.3.8 Correlation**

In order to test the conceptual model described in chapter 4, tests of association were required. The method, which looks for an association between continuous variables, is called correlation. In order to examine any association further, the degree of association was measured via the calculation of a correlation coefficient. To calculate a Pearson product moment correlation coefficient it is required that the data on at least one of the variables has normal distribution in the population. Following the calculation of the correlation coefficient a confidence interval was calculated and then a hypothesis test was performed.

### **5.3.9 Partial correlation coefficients**

Because of the nature of the using two measures of reflection, if two significant results were obtained for the two types of reflection correlated with an aspect of patient safety, this might be due to the different types of reflection influencing the

other. Partial correlation coefficients offer a method to identify and address the influence of variable on one another (Altman 1991).

### **5.3.10 Representativeness of the sample**

The demographics of the sample were recorded in terms of gender, and graduate or non-graduate status at entry to the MBChB course. To identify if the sample was representative of the cohort overall a histogram was produced to give a visual indication of the representativeness of the sample. In addition 95% confidence intervals were calculated for the sample means. These in combination would give an indication of the representativeness of the sample.

## **5.4 Results**

A sample of 61 students was recruited from year 3 medical students. All participants completed three questionnaires.

The sample included 45 female students and 16 male students, 42 non-graduate entry students and 19 graduate entry students to the MBChB course. It was not possible to identify if these students had participated in study 1 due to the anonymity of the study 1 participants.

### **5.4.1 Reliability**

It was not possible to establish the reliability of the Measure of Epistemological Reflection.

The scales showed acceptable levels of internal consistency

Cronbach alpha

Reflection 0.71

Critical reflection 0.71

Patient safety questionnaire 0.90

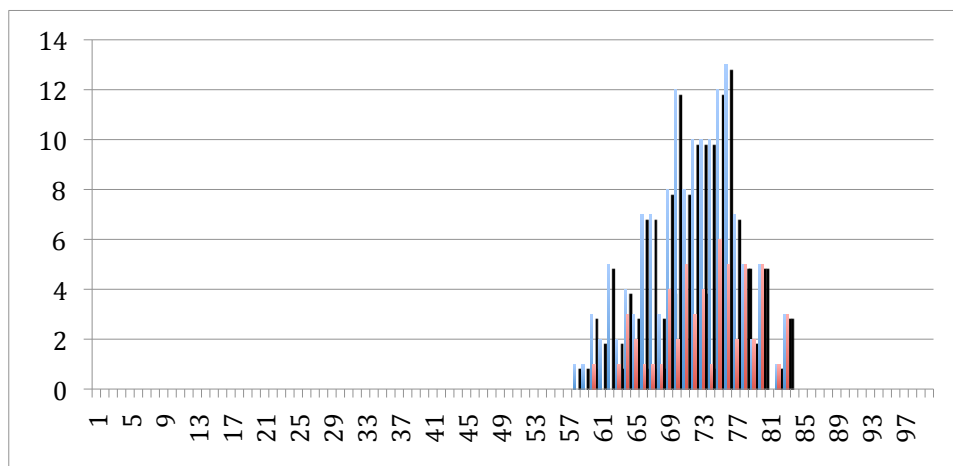
24 correlation coefficients were then calculated. These are shown in Table 9.

Two scales in the patient safety questionnaire showed lower levels of internal consistency. The values are shown in table 9.

#### 5.4.2 Representativeness of the sample

The histogram is shown below. The confidence intervals for the population mean of the year group and the sample are shown below

	Year group	Study sample
Population mean	71.64	73.53
95% confidence intervals	70.34 - 72.54	72.09 - 74.96



**Chart 1 Histogram of representativeness of sample in study 2**

Histogram with the X axis representing OSCE marks (% scores) for year group overall and study sample. The year group are the series in blue and the sample group are shown in red. The Y axis shows the number of candidates.



	Level of Knowledge	Knowledge of actions to take	Feelings about error 1	Feelings about error 2	Personal attitudes	Safety in the workplace	Personal influence	Future intentions
Cronbach Alpha of patient safety scale	0.80	0.82	0.85	0.89	0.63	0.88	0.29	0.76
Reflection	0.061	0.435 p=0.0002	-0.054	0.093	0.144	-0.160	0.070	0.300 p=0.0097
Critical Reflection	0.086	0.274 p=0.0162	0.119	0.111	0.337 p=0.004	0.135	0.076	0.400 p=0.0007
Measure of Espitemological reflection (Intellectual development)	-0.016	0.174	-0.059	0.097	0.231 p=0.03	-0.056	0.222 p=0.04	0.065

**Table 9**

**Correlation coefficients testing association between patient safety and reflection, critical reflection and intellectual development. The cronback alpha for the scales is included to give an indication of reliability.**

	Correlation coefficient	P Value	95% confidence interval
Reflection and Knowledge of actions to take	0.435	0.0002	0.21-0.62
Critical Reflection and Knowledge of actions to take	0.274	0.0162	0.02-0.49
Reflection and intentions regarding patient safety	0.300	0.0097	0.05-0.51
Critical Reflection and intentions regarding patient safety	0.400	0.0007	0.16-0.59

**Table 10**

**p values and 95% confidence intervals for significant correlation coefficients in reliable scales (Cronbach alpha >0.70)**

As can be seen from these data, two of the patient safety questionnaire sections were significantly correlated with both reflection and critical reflection. Therefore partial correlation coefficients were calculated to look at the influence of reflection and critical reflection on the corresponding result (Altman 1991).

	Knowledge of actions to take	Future intentions
Reflection	0.33 p = 0.009	0.14
Critical Reflection	0.09	0.28 p = 0.02

**Table 11****Partial correlation coefficients and p values**

## 5.5 Discussion

The aims of this study were to identify measures of reflective thinking, intellectual development, error and safe behaviour that could be used in medical students.

Following this, to evaluate the reliability of these measures and then to determine if any associations existed between reflection, intellectual development, and patient safety (including error and safe behaviour) at Kirkpatrick's level 2, that of knowledge and attitudes.

At the point the methods will be discussed so that any inferences made about the results can be considered alongside any weaknesses in the study design. This returns to the triad described in chapter 4 of objectivity, validity and reliability.

In terms of objectivity the questionnaires that were identified through the literature search required triangulation to avoid bias. Experts in the field of reflection and patient safety were consulted to identify if any measurement tools for these constructs had been missed. No other questionnaires were identified through this process.

The representativeness of the convenience sample was important to ascertain. It had been decided to use the cohorts' OSCE scores and this was included in the consent. In retrospect it might have been more appropriate to use their knowledge examination scores. However the OSCE scores offer a reasonable way of establishing representativeness. As can be seen from the histogram (chart 1) the study sample seemed overall representative. It could be commented that the high scorers in the year overall, were all also in the study group. When the means are reviewed with 95% confidence interval, the confidence intervals for the means overlap.

The questionnaires formed the basis for establishing associations between the individual factors identified in the pilot study. Therefore, the concept of the validity of these questionnaires is key to any inferences drawn from the results. In short, how do we know that these represent 'the truth' in terms of reflection, intellectual development and understanding of patient safety?

It is recommended that in newly developed scales the internal consistency values (Cronbach alpha) should have a value of greater than or equal to 0.70. (Nunnally 1978). In the reliability analysis the reflection scales met this criteria and in the patient safety question six of the eight scales met this criteria.

The difficulty in establishing the reliability of the Measure of Epistemological Reflection (Intellectual Development) is discussed above. Therefore it was decided that inferences would be drawn where this measure was tested against patient safety scales that had met acceptable levels of reliability. Therefore the two significant results were not considered to be reliable and intellectual development was no longer included within the developing conceptual model.

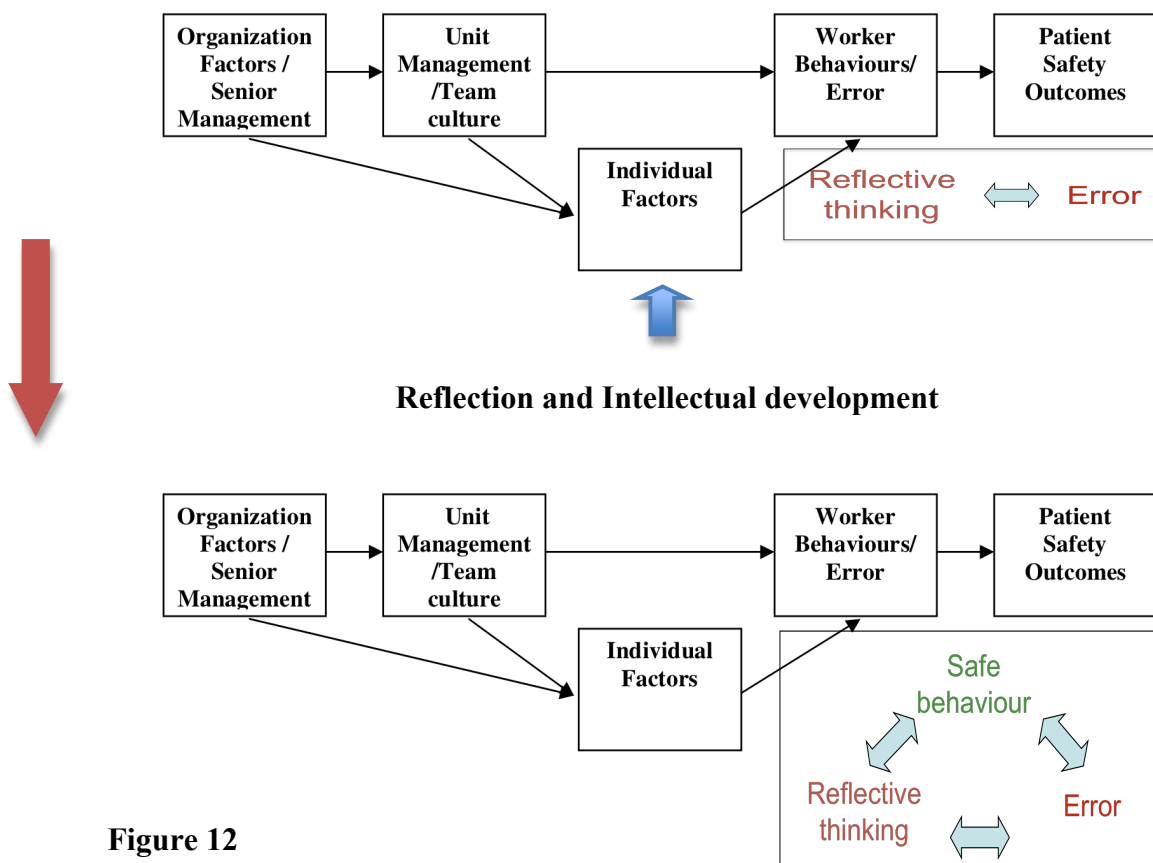
Having established the reliability of the scales significance tests were then carried out. As described in chapter 4, tests of association need to be considered carefully. There is some discussion in the literature about how to interpret significant correlations. Some authors advocate the use of an adjustment to allow for type I errors; which is where there is a risk of assuming an association when one is not actually there. The Bonferroni correction is used to address this, this is where multiple tests of

association are carried out and the level of significance is adjusted to allow for the number of tests. This is often used in repeated testing of individuals. Its applicability in this study can be questioned, however it raises an important aspect to consider in terms of the interpretation of the significant p values obtained in the results. The risk with the Bonferroni correction is that by applying too stringent an approach to type I errors you may result in making type II errors where you assume that there is not an association where one does actually exist.

Therefore in the literature there are a number of authors who advocate the use of either using a higher level of significance such as 0.01 or the use of confidence intervals in the interpretation of the significance of correlation coefficients.

Using significance levels of 0.01 and confidence intervals in the scales, which demonstrated high levels of reliability, demonstrates a number of significant results in this study, which appear to link reflection with two areas of knowledge and attitudes towards patient safety. These were knowledge of actions to take and future intentions regarding patient safety. As can be seen in the results section a further statistical test was carried out on these to understand the influence that critical reflection and reflection had on each other in terms of these results. By completing the statistical test of calculating partial correlation coefficients this influence was revealed and the results indicated that reflection was associated with knowledge of actions to take and critical reflection with future intentions. Using the more stringent criteria for significance of a level of 0.01, the result that was most significant was reflection and knowledge actions to take.

Returning to the theory outlined in chapter 3 this links clearly to the theories of reflection and the difference between reflection and critical reflection. Reflective ability at the lower level described in the literature (Mezirow 2000) relates to focussing on methods and processes and this result appears to confirm this in the context of patient safety. The dynamic between reflection and worker behaviour is complex.



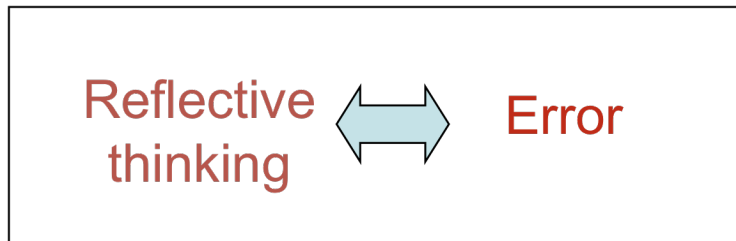
**Figure 12**

**Key factors influencing patient safety: Jackson, Flin 2009. Refinement of conceptual model between studies 1 and 2.**

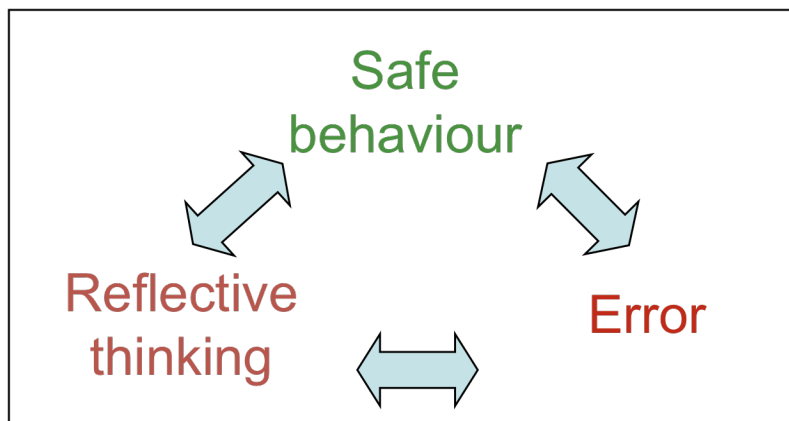
A triangular relationship appears to emerge from the results of the studies, which show separate relationships between error and safe behaviour and reflective ability.

This is shown below in figure 21

Safe  
behaviour



The dynamic of reflection, error and safe behaviour at the end of study 1



The dynamic of reflection, error and safe behaviour at the end of study 2

**Figure 13**

**Development of conceptual model of reflective thinking, safe behaviour and error between studies 1 and 2.**

## 5.6 Summary

This study has used the methodological approach identified in chapter 4 to critically enquire about the relationship between individual factors and worker error and safe behaviour at the Kirkpatrick's level two. This has resulted in the refinement of the conceptual model to include safe behaviour.



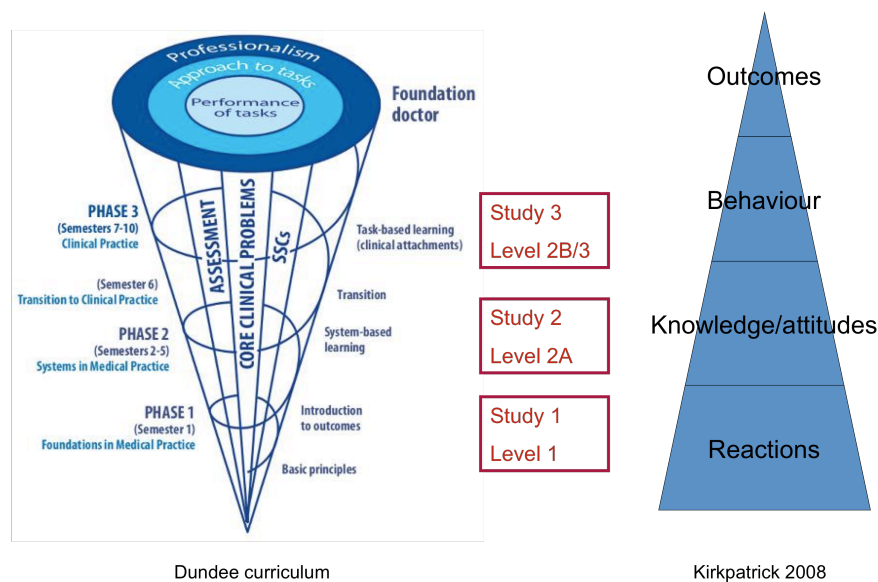
## Chapter 6

### Study 3

#### Testing and modification of the model at Kirkpatrick level 3

##### 6.1 Overview of chapter

This chapter reports the third study in this thesis, which tests the model at the level of behaviour using the adapted model, which was described in Chapter 5.



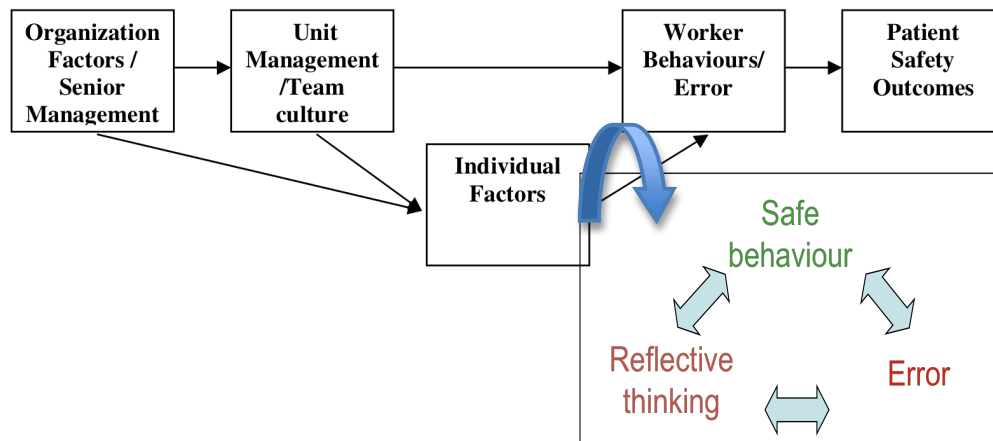
**Figure 9**

#### Overview of the studies aligned to the spiral curriculum and Kirkpatrick

##### 6.2 Introduction

In chapter 5 the associations between reflective thinking, safe behaviour and error were identified at the outcome level of knowledge and attitudes. Two significant associations were identified following the analysis of these data. These were an association between reflection and knowledge of actions to take, and critical reflection and future intentions. These two results therefore influenced the original

concepts which had been developed from the focus group data, and resulted in the development of a triangular model identifying the possible associations between the individual factor reflection and safe behaviour and error which is shown below.



**Figure 1**

**Key factors influencing patient safety: Jackson, Flin 2009 and the conceptual model of reflection, error and safe behaviour**

Therefore the next step in testing the conceptual model was to look at these relationships or associations at a higher level within Kirkpatrick's framework as shown in Box 2. The study described in chapter 5 was at the level of knowledge and attitudes and therefore the next step in modelling process and outcomes as described in the MRC framework for complex interventions would be to test the model at level 2B to skills and level 3 behavioural level. In this setting the use of Kirkpatrick was not used to test an intervention but to explore the conceptual model.

Kirkpatrick's levels:

Level 1: Participation—covers learners' views on the learning experience, its organisation, presentation, content, teaching methods, and aspects of the instructional organisation, materials, and quality of instruction

Level 2a: Modification of attitudes or perceptions—outcomes here relate to changes in the reciprocal attitudes or perceptions between participant groups towards intervention or simulation

Level 2b: Modification of knowledge and skills—for knowledge, this relates to the acquisition of concepts, procedures, and principles; for skills this relates to the acquisition of thinking and problem solving, psychomotor and social skills

Level 3: Behavioural change—documents the transfer of learning to the workplace or willingness of learners to apply new knowledge and skills

Level 4a: Change in organisational practice—wider changes in the organisation or delivery of care, attributable to an educational programme

**Box 2 Kirkpatrick's Framework in health professional education (Barr 2000)**

### **6.2.1 Hypothesis**

The hypothesis of this study is that an association exists between reflective thinking, error behaviours and actions relating to safe behaviour.

### **6.2.2 Aims**

This study aimed to:

- Identify measures of error and safe behaviour at skills and behavioural level
- Evaluate the reliability of these measures in the cohort of students
- Determine if associations exist between reflective thinking, error and safe behaviour at Kirkpatrick's levels 2B and 3

## **6.3 Methods**

In order to test the hypothesis described above, the same approach to rigour in the research method was applied, informed by the theory described in chapter 4.

### **6.3.1 Study design**

As in the study described in chapter 5, there were no studies in the literature, which described a link between reflection and patient safety in terms of either error behaviour or safe behaviour. There are studies, which described methods of measuring error behaviour, and studies in different contexts, which look at safe

behaviours (Morey 2002, McCulloch 2009).

One of the challenges in research and patient safety is that many studies are retrospective, looking at perceptions of behaviours following a significant untoward incident or patient safety incident (Dornan 2009). There are relatively few prospective studies and the ones that have occurred such as the Morey and McCulloch studies have taken place in specialist departments in healthcare organisations with the staff that work in them (Morey 2002, McCulloch 2009).

The studies that measured error use this as part of the evaluation of the intervention to improve patient safety by team training in registered health professionals. There are two studies in the published literature, which described similar methods. Morey in 2002 used a method of direct observation to identify error behaviours in an emergency department and McCulloch in 2009 used a similar approach in an operative theatre setting (Morey 2002, McCulloch 2009). Each study used different statistical methods to establish the reliability of the judgments about error behaviour, but each used direct observation. Morey used Cronbach alpha and McCulloch used a different method from within classical test theory.

In order to test the hypothesis both these approaches needed to be applied in an appropriate context for year five medical students in Dundee.

### **6.3.2 Ward simulation exercise**

To translate these methods used in the published literature directly to year five medical students would not be appropriate in the structure of the Dundee curriculum.

However, Dundee has a longstanding history of innovation in clinical skills and over a number of years has developed a ward simulation exercise where year five medical students manage a simulated ward taking on the role of the foundation doctor. In terms of Kirkpatrick this exercise involves the demonstration of skills in a simulated workplace. The ward simulation exercise moves beyond the pure acquisition of individual skills and involves the use of them with patient in a realistic ward. In terms of the levels described by Barr (2000) it could be argued that it is beyond 2B but not fully at level 3. One problem with the ward simulation exercise is that there is little published evidence apart from one paper by Ker (2006) that can help to demonstrate this analysis of its position in Kirkpatrick's framework. Research methodology was applied in the development of simulation exercise and included a pre-design stage involving shadowing new graduate doctors, focus groups, a literature review, a review of patient admissions and incorporation of findings of a 360' performance screening tool used with junior doctors. In the design stage a range of patient scenarios were identified which required the inclusion of an acute emergency, skills relating to documentation and communication, a semi-elective admission and inpatient complications. In addition, errors and potential prescribing pitfalls were identified as appropriate to be included in the design.

The ward simulation exercise was piloted and evaluated using semi-structured interviews with the junior doctors who participated in the pilot (Ker 2006 ). From these interviews, realistic components and nonrealistic components were identified and the design of the ward simulation exercise was modified in response to these. The realistic components included the need to prioritise, including relevant tasks; team working, the handover process and the nonrealistic components included the use of

mannequins, the presence of observers and orientation to the simulated ward. The nonrealistic components were then modified in the design of the ward simulation exercise to improve the realism. This was done through the use of simulated patients and remote observation via the use of video cameras.

The simulated exercise for year five students offered an appropriate setting in which to test the students' skills and behaviours relating to error and safety. In an unfunded study the availability of the ward simulation exercise was also an important factor. All year five students participate in it. The work by Ker (2006) suggests that the ward simulation exercise has components of Kirkpatrick levels 2B and level 3. This is important to note in terms of how any results could be interpreted with the levels. Non-technical skills and higher cognitive functions resembled the workplace but lower cognitive skills such as procedural skills with mannequins were perceived to be at level 2B.

### **Structure of the exercise**

The ward simulation exercise involves each student taking charge of a simulated three-bedded ward for a period of 20 minutes. At the start of the exercise, the student receives a handover from a clinician. There are three patients on the ward, and simulated patients are used to fulfill these roles. Simulated patients are either volunteers or paid individuals who take on the role of a specific patient in order to facilitate students learning. In this way, the focus can be on the learner and their needs, rather than on the patient, whose need to take priority in a clinical setting.

The ward simulation exercise is intended to present the students with a series of tasks,

which they need to prioritise. The patient's roles are standardised, and there are standardised interruptions at set points during the 20 minutes. The three simulated patients represent different skill sets. One is a routine admission, the second is an advanced communications scenario and the third is an emergency situation that requires students to demonstrate acute-care skills. In addition to the students responding to these patients needs, there are phone calls that need a response such as a request from pharmacy about discharge medication and other routine ward work that needs to be completed. The idea of this is to be able to evaluate students' non-technical skills, such as clinical reasoning and prioritisation, which are key to patient safety.

### **6.3.3 Measures of safe behaviour**

Alongside the development of the ward simulation exercise, an assessment tool for safe behaviour within the exercise has been developed and validated. This tool has been tested in both undergraduates and postgraduates (McIlwaine 2007). A set of 36 items was identified using a modified Delphi process. The participants of the Delphi were senior doctors with experience of junior doctors and they were asked to identify positive attributes relating to good medical practice (MacIlwaine 2007). These items were grouped under seven headings of safe behaviour and can all be mapped to the WHO patient safety competencies (Walton 2010).

1. General overview
2. Clinical skills
3. Critically ill patient
4. Prescribing/documentation
5. Response to interruptions



## 6. Communication

## 7. Health and safety

Two independent senior medical clinicians assess each candidate. The assessors are asked to give a score on a five-point scale. The assessors are also asked what behaviours the candidate exhibited, what their strengths were and what the candidates needed to improve. The reliability of the measure in undergraduates has not been published. As this measure had been developed via a research methodology but had not been fully validated it was decided to use it but to conduct reliability tests alongside its use. The postgraduate exercise has undergone a validation study, had been presented but not published (Hislop 2009, Ker 2009) and was suggestive that the use of a global score was more reliable than a checklist. Reviewing the assessment literature (Regher 1998) using global scores in each of the seven categories would give an acceptable approach. The purpose here was not to identify if a candidate had passed or failed but if there was an association with the candidates level of reflective thinking and errors. From reviewing the exercise as a tutor it was apparent that the majority, if not all, candidates demonstrated errors in the exercise to a greater or lesser degree and therefore correlation would need to be used as a test of association. In this setting the option of combining the global scores in each category offered a suitable measurement of safe behaviour, without published evidence to suggest an alternative approach.

### **6.3.4 Measures of error behaviour**

As shown in the literature error can be viewed in many different ways. Error could either be systematically logged or judgments can be made as to whether an error has clinical significance. Measures of error behaviours were collated from the assessors'

descriptive accounts of the candidates' behaviours within the ward simulation exercise. The assessors make detailed notes, which describe these behaviours in detail.

The method applied here used a combination of the methodological approach that was used in the Morey and McCulloch (Morey 2002, McCulloch 2009) studies which used either in narrative description of the error behaviours or ethnographic free-form notes of all the behaviours observed.

From these data, errors which the assessors identified in the students behaviours, were noted and then categorised using Rasmussen's and Reason's model of cognitive error which includes:

- Skill based error
- Rule based error
- Knowledge based error

### **6.3.5 Reflective thinking**

The questionnaire used in study two which is described in chapter 6 was used again in this study to measure levels of reflection and critical reflection (Kember 2000). These were completed on the same day as the students participated in the ward simulation exercise.

### **6.3.6 Self assessment and critical reflection**

An association between critical reflection and future intentions regarding patient safety was identified in study two. This association is more complex to test at

behavioural level. Critical reflection and safe behaviour can be tested from the data sources above, however future intentions and how these translated into practice are more complex. The purpose of this study was to test the model of reflective thinking, error and safe behaviour at behavioural level rather than exploring this association further. It was therefore decided to collect data from the students about their intentions following feedback about their performance in the ward simulation exercise within the study. It was recognized that this was still at Kirkpatrick's level two but would help to inform the model.

Students responded to four statements using a five point Likert scale. The statements included the following:

- i) The feedback from the tutor about the ward simulation exercise has been valuable for me
- ii) Feedback about my clinical performance in the ward simulation has highlighted important issues for me
- iii) Feedback about my clinical performance in the ward simulation exercise has highlighted areas of concern in my performance
- iv) Following the feedback I am planning changes in my clinical practice

### **6.3.7 Ethics**

Ethical approval was sought and granted for the study from the University of Dundee research ethics committee

### **6.3.8 Sample**

Following discussion with the ethics committee all year five medical students were invited to participate in the study. A calculation was performed which suggested that

a sample size of between 50 -70 students would be required to demonstrate moderate associations within the model.

### **6.3.9 Recruitment**

All students were asked if they were willing to participate in the study following participation in the ward simulation exercise. An email with the invitation to participate was sent to the year group in advance. They were given information sheets and an explanation of what participation meant. They were also given the opportunity was to withdraw at any time if they decided not to participate.

### **6.3.10 Data collection**

The following data was collected for all participating students; the assessor scores for each of the seven categories and the free text responses from the assessors about the students' behaviours in the ward simulation exercise.

### **6.3.11 Statistical analysis**

The statistical analysis fell into two sections. The first was to establish the reliability of the questionnaires and the assessment tools. If these demonstrated acceptable levels of internal consistency then further analysis of these data was carried out.

### **6.3.12 Reliability**

The self-administered questionnaires were assessed for reliability using Cronbach Alpha. These questionnaires included the reflective thinking questionnaire and the self-assessment questionnaires the students completed following the ward simulation exercise. The reliability of the assessment by the expert assessors was assessed using

generalisability theory.

### **6.3.13 Generalisability theory**

As described in chapter 4 generalisability theory offers a method of analysis which can disentangle the multiple sources of error (variance) which influence the reliability of an assessment. Generalisability theory addresses the limitations of classical test theories such as Cronbach Alpha by enabling estimations of reliability of multiple assessors, in this situation, two assessors. A statistical program G-string III was used to calculate the generalisability coefficient. Values for this coefficient closer to 1.0 suggest high levels of reliability. In the Morey (2002) study reliability of error judgment was made using Cronbach alpha. In this study it was decided to use both approaches to look at reliability as there was not definitive method described within the literature for this situation

### **6.3.14 Testing the model via the use of Correlation**

Again in this study, as in study two, correlation was used to test associations between continuous variables measured above. Pearson product moment correlation coefficients were calculated. In addition, confidence intervals were calculated and then hypothesis tests were performed. Each axis in the model would be tested for reflection and then critical reflection.

### **6.3.15 Representativeness of the sample**

A test of representativeness was also carried out. To identify if the sample was representative of the cohort overall a histogram was produced to give a visual indication of the representativeness of the sample using the students marks in the

ward simulation exercise compared with the year group overall. In addition 95% confidence intervals were calculated for the sample means. These in combination would give an indication of the representativeness of the sample.

## **6.4 Results**

A sample of 48 students was recruited from the year five medical students. All participants completed the reflective thinking questionnaire and self assessment questionnaire and consented to the documents from their Ward simulation exercise being used for the study. The sample consisted of 19 male students and 29 female students. These data was otherwise anaonymised and so it was not possible to identify if participants in study three had participate din either of the two earlier studies.

### **6.4.1 Reliability**

The self-administered questionnaires showed acceptable levels of internal consistency;

	Cronbach Alpha
Reflection	0.70
Critical reflection	0.78
Self assessment of ward simulation exercise performance	0.85
Response to feedback questionnaire	0.74

A generalisability coefficient was calculated for the assessed ward simulation exercise scores with two assessors;

Generalisability coefficient
0.84

As discussed above a combination of coefficients were calculated for the error scores

Reliability of assessors' judgements using the error framework with two assessors;

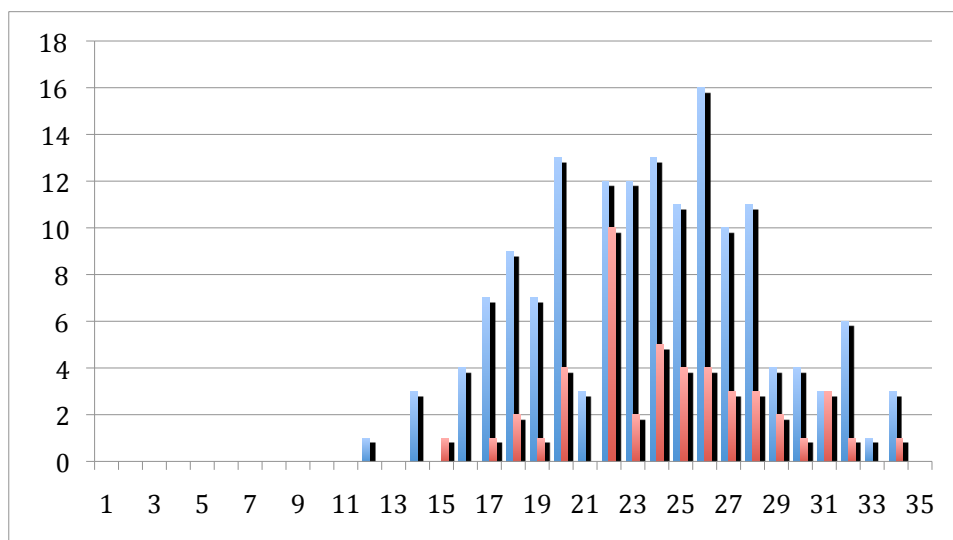
Cronbach Alpha 0.70 (0.6997)

Generalisability coefficient 0.52

#### 6.4.2 Representativeness of sample

The histogram is shown below. The confidence intervals for the population mean of the year group and the sample are shown below

	Year group	Study sample
Population mean	23.54	24.54
95% confidence intervals	22.79 - 24.28	23.28 - 25.75



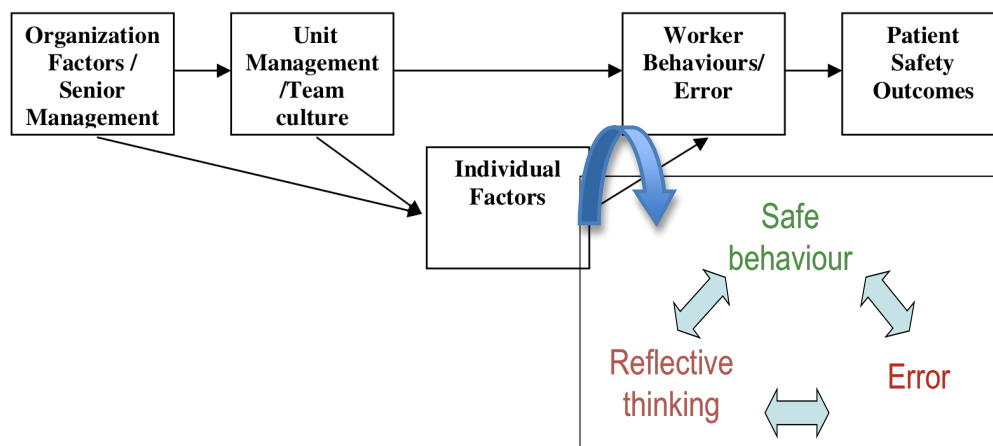
**Chart 2 Histogram of representativeness of sample in study 2**

Histogram, with the X axis representing the ward simulation exercise marks for year group overall and study sample. The year group are the series in blue and the sample group are shown in red. The Y axis shows the number of candidates.

### 6.4.3 Associations within the model

Testing the model involves three stages:

- Associations between reflection, error and safe behaviour
- Associations between critical reflection, error and safe behaviour
- Associations between safe behaviour and error



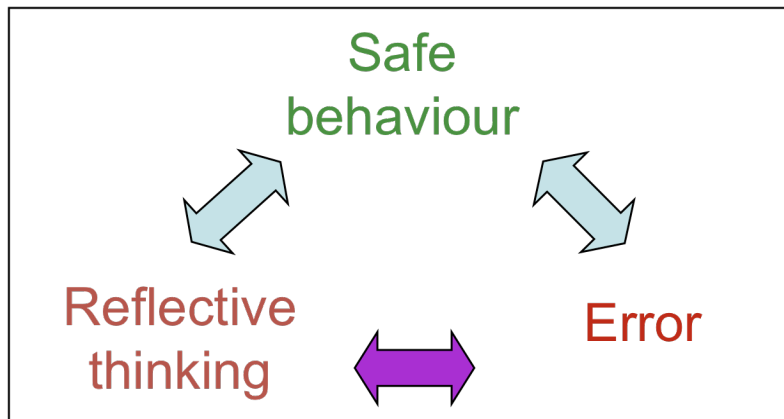
**Figure 1**

**Key factors influencing patient safety: Jackson, Flin 2009 and the conceptual model of reflection, error and safe behaviour**

Each axis is presented in the following tables. The arrow is highlighted in purple to show which axis within the model is being presented.



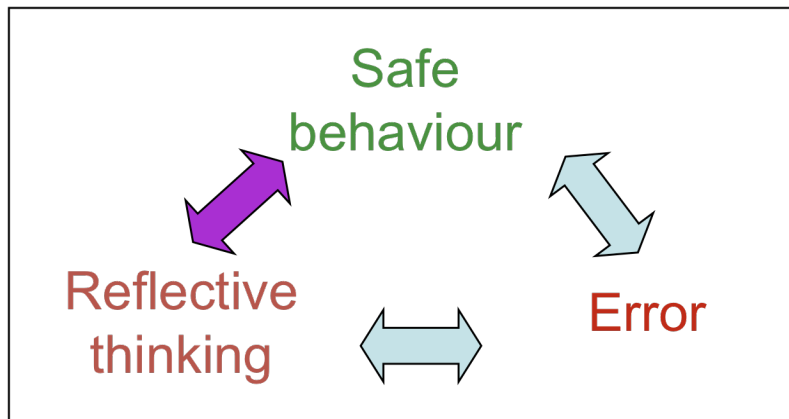
a) **Associations between reflection, error and safe behaviour**



	Correlation coefficient	P Value	95% confidence interval
Reflection and Number of Skill based errors	0.09	0.46	--
Reflection and Number of rule based errors	0.24	0.04	-0.03 – 0.54
Reflection and Number of knowledge based errors	-0.30	0.03	-0.54 – -0.02

**Table 12**

**Results of correlations between Reflection and error**

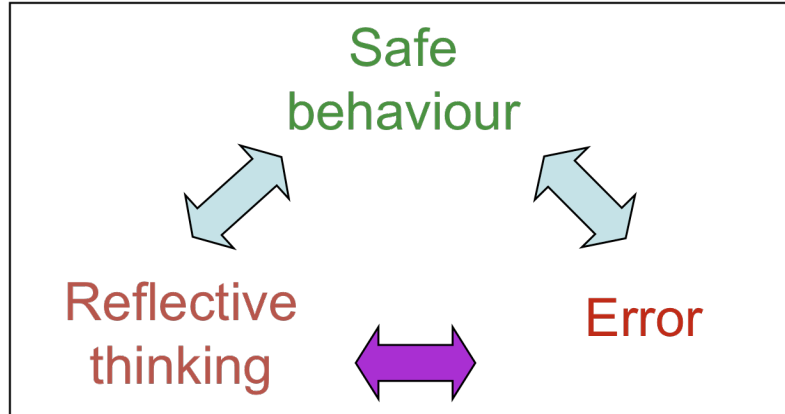


	Correlation coefficient	P Value	95% confidence interval
Reflection WSE scores	0.05	0.48	--

**Table 13**

**Results of correlations between Reflection and safe behaviour**

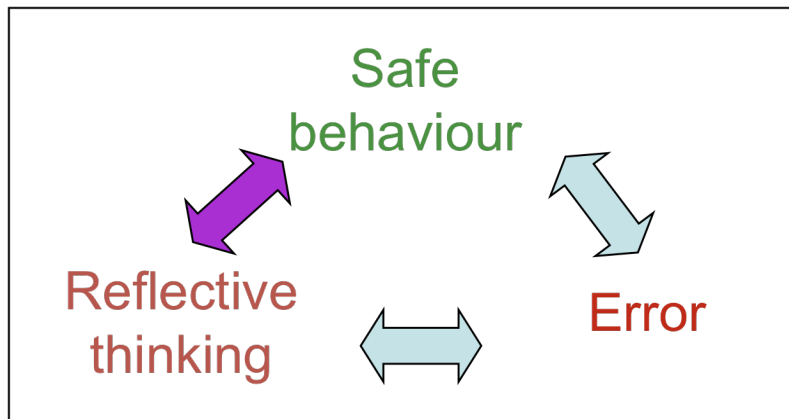
b) Associations between critical reflection, error and safe behaviour



	Correlation coefficient	P Value	95% confidence interval
Critical reflection and Number of Skill based errors	0.07	0.47	--
Critical reflection and Number of rule based errors	0.04	0.48	--
Critical reflection and Number of knowledge based errors	0.06	0.48	--

**Table 14**

**Results of correlations between Critical Reflection and error**

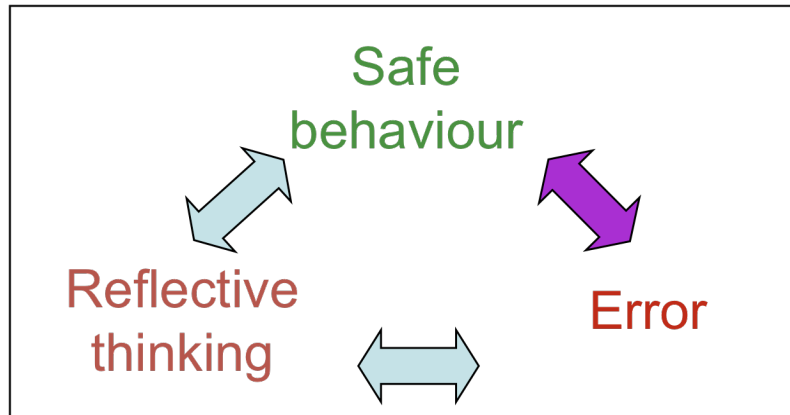


	Correlation coefficient	P Value	95% confidence interval
Critical reflection WSE score	- 0.05	0.48	--

**Table 15**

**Results of correlations between Critical reflection and safe behaviour**

c) Associations between safe behaviour and error



	Correlation coefficient	P Value	95% confidence interval
Number of skill based errors and Ward Simulation Exercise score	-0.4978	0.0001	-0.68 -- -0.24
Number of rule based errors and Ward Simulation Exercise score	-0.4721	0.0003	-0.67 – -0.22
Number of knowledge based errors and Ward Simulation Exercise score	-0.5088	0.0001	-0.69 – - 0.26

**Table 16**

**Results of correlations between safe behaviour and error at behavioural level**

#### 6.4.4 Self assessment and reflective thinking

Statement	Reflection Correlation Coefficient	Critical Reflection Correlation Coefficient
The feedback from the tutor about the ward simulation exercise has been valuable for me	0.09	-0.06
The feedback about my clinical performance in the ward simulation has highlighted important issues for me	-0.01	-0.13
The feedback about my clinical performance in the ward simulation exercise has highlighted areas of concern in my performance	-0.24 P=0.05	0.11
Following the feedback I am planning changes in my clinical practice	0.06	0.54 P=0.0000036

**Table 17**

**Results of correlations between responses to feedback and different types of reflective thinking**

### 6.4.5 Summary of results

In the approach used here, where different axes in the conceptual model were tested individually, there are two sets of correlation coefficients, which show significant results.

There are two significant associations demonstrated between reflection and error.

Reflection is positively correlated with the number of rule-based errors with a correlation coefficient of 0.24  $p=0.04$  and reflection is negatively correlated with the number of knowledge based errors with the correlation coefficient of -0.30  $p=0.03$ .

When the axis of safe behaviour and error was tested for an association there were negative correlation coefficients between the ward simulation exercise scores and the number of skill based errors, rule-based errors and knowledge based errors.

- Correlation coefficient for the number of skill based errors and ward simulation exercise score was -0.48  $p=0.0001$
- Correlation coefficient for the number of rule-based errors and the ward simulation exercise score was -0.47  $p=0.0003$
- Correlation coefficient for the number of knowledge based errors in the ward simulation exercise score was -0.51  $p=0.0001$

When the different types of reflective thinking were tested for associations with the response to feedback one correlation coefficient was significant; the association between critical reflection and positive responses to the statement “following the feedback I'm planning changes in my clinical practice” had a correlation coefficient of 0.54  $p=0.0000036$ .

## **6.5 Discussion**

The results of this study will be discussed both in the context of this individual study and in the context of the thesis overall. The studies described in the thesis link together and therefore influence the discussion of this study. This section will focus initially on a discussion of how the initial aims were achieved followed by a discussion of the strengths and weaknesses of the study.

The aims were to:

- Identify measures of error and safe behaviour at skills and behavioural level.
- Evaluate the reliability of the measures of error and safe behaviour in the cohort of students.
- Determine if an association existed between reflective thinking, error and safe behaviour at Kirkpatrick's level 2B and 3.

### **6.5.1 Discussion of methods**

The design of the study enabled the assessment of safe and error behaviours in a simulated workplace. The use of the ward simulation exercise represented a standardised workplace setting. The previous work that has been carried out in Dundee in terms of developing the realism of the ward setting and the exercise and the development of an assessment tool enabled safe behaviours to be measured reliably. The generalisability coefficient for the assessors' judgment of safe behaviour in the ward simulation exercise was very high. As stated earlier, Dundee have carried out their own reliability analysis using a Rasch based generalisability analysis which for the cohort overall has had a value similar to the one calculated here. This suggests that the generalisability coefficient calculations completed in the study were



performed in a rigorous manner. Therefore in terms of the aims, an appropriate environment was identified in which the test safe behaviour and error and measures of safe behaviour were identified and the reliability of them established in the sample recruited for the study. The intention of this study was to explore the model higher up Kirkpatrick's framework, ideally at level 3. As discussed earlier simulation is often considered to be at level 2B. However here it could be argued that the areas that demonstrated significant associations were at higher levels of cognitive functioning. These were the areas that had been identified as most similar to the workplace in Ker's study about realism in the ward simulation exercise (Ker 2006)

The ability to test the conceptual model in a sample of students from the same cohort used in the earlier two studies is an additional strength. This is the cohort from which the conceptual model arose in study one and was modified in study two. Therefore, it adds strength to the methodology that the model has now been tested at skills and behavioural level in the same cohort. Additionally, the design has allowed this to be tested in year 5 of the Dundee curriculum when the students were about to move on to become doctors. When testing new theory and establishing its validity through the process described in this thesis, it is important in the first stages that the theory was established and modelled in the same cohort before being tested in other groups. However the sample size was at the lower limit of the calculations for sample size that would be required to demonstrate associations between the components of the model. At this time of the third study the principal researcher was not working in Dundee and relied upon the support of the skills team to recruit the participants. This may have influenced recruitment. Additionally, due to ethical considerations, participants were recruited after they had completed the exercise. This may have also resulted in lower

recruitment rates. Although the sample size was not as large as anticipated the sample was representative of the year when ward simulation exercise scores were compared.

A further point was that due to the anonymised nature of participation it was difficult to identify which students had participated in all three studies.

### **6.5.2 Error and safe behaviours**

An area which proved to be challenging in this study, and is an area of potential weakness, is that of the assessment of error behaviour and the reliability of the measures of error in the ward simulation exercise. As described in the methods, there are very few articles in the published literature, which give a method of prospectively measuring error behaviours, which could be applied in this setting. Therefore a hybrid method was used to identify and assess error behaviours. This thesis was not funded and therefore this study relied upon existing processes within the year five ward simulation exercise. This meant that the same assessors who were assessing safe behaviour assessed error behaviour. This method was used in the MedTeams study (Morey 2002) but their analysis of error behaviour was more detailed. Establishing the reliability of the error behaviour measures was difficult. In the studies described, one used Cronbach alpha and the other described a combination of methods, which could not be readily transferred to this study. Therefore it was decided to calculate both a Cronbach alpha coefficient and a generalisability coefficient. The Cronbach alpha reaches an acceptable level but the generalisability coefficient was lower. When associations were tested between error and safe behaviour, significant correlations were identified across all three error groups. These results have immediate resonance,

as they describe a negative correlation with safe behaviour. This suggests that safe behaviour is linked to lower error rates. This corresponds to the Cronbach alpha result and is similar to the results in the studies which measured error described above. The correlation coefficients were negative at levels of around 0.5 and all had significance levels beyond 0.01. This suggests that the error framework was consistently measuring behaviours that were opposite to safe behaviour, which were similar but not exactly, the same. This raises a possible problem with either the assessors identification of error behaviour or the way that the generalisability coefficient was calculated for the error framework. These results suggest that the nature of error in the ward simulation exercise and the dynamic with safe behaviour requires further exploration.

Although this raises questions about how associations with error can be interpreted it does not suggest that these associations should not have been tested. The associations within the model were tested via the use of correlation.

There are two areas, which need discussion, and these will be introduced here and explored further in chapter 7.

### **6.5.3 Reflection and error**

Two significant results were shown when the axis of reflection and different types of error was analysed. There was a negative correlation between reflection and the number of knowledge-based errors with correlation coefficient of -0.30  $p=0.03$  and a correlation between reflection and the number of rule-based errors of 0.24  $p=0.04$ .

These results suggest that higher scores in reflective thinking at the level 3 which

focuses on reflecting about processes and methods is protective for knowledge-based error. Conversely the results for rule-based errors suggest that this type of reflective thinking may make an individual less likely to follow a clinical rule.

These results were not significant at the 0.01 level and in the result between reflection and rule-based error the confidence interval crossed zero. Therefore this result needs to be considered in light of this. However returning to Rasmussen's and Reason's original model, the suggestion is that these types of error are associated with higher levels of cognitive input as you climb the error hierarchy from skill-based error at the bottom to knowledge-based error at the top. It would therefore appear possible that higher levels of reflective thinking would be protective for knowledge-based error.

#### **6.5.4 Safe behaviour and reflection**

One notable point is the apparent lack of an association between reflection or critical reflection and safe behaviour. This returns to the original focus group data, in study one, where the interpretation linked error to reflective thinking rather than safe behaviour. Here this link has arisen again. When reviewing the literature in chapter 2, the original reports on error (Kohn 2000), which suggest that error is indeed the trigger the organisational learning as can be seen in processes such as root cause analysis. The results presented here, appear to reiterate this concept from a different perspective, that of medical students.

One specific programme of work has attempted to link reflection to patient safety and quality improvement. Whittich (Whittich 2011) has linked quality improvement with a theoretical base from educational theory. This time with critical reflection via

Mezirow's work. Whittich (Whittich 2010) developed and validated a tool to measure reflection in interns' quality improvement projects. Whittich (Whittich 2011) then tested for an association between the quality of the quality improvement projects and critical reflection but was unable to demonstrate an association.

This will be discussed further in chapter 7, where the results of study three will be discussed alongside the results of studies one and two with further reference to Whittich's work and the rest of the background literature and educational theory. It could be argued that the wards imulation exercise does not measure safe behaviour, but the Delphi process suggests that the constructs were developed by an acceptable methodology (McIlwaine 2007)

## **6.6 Summary**

This study tested the model at behavioural level within a simulated ward environment. The study demonstrated some associations between reflection and error and safe behaviour and error. The implications of this study are discussed further in chapter 7.

## **Chapter 7**

### **Discussion of overall methods and results from studies 1-3**

#### **7.1 Overview of chapter**

This chapter will discuss and critique the methods used and then go on to discuss the implications of the results of all three studies in terms of the background literature.

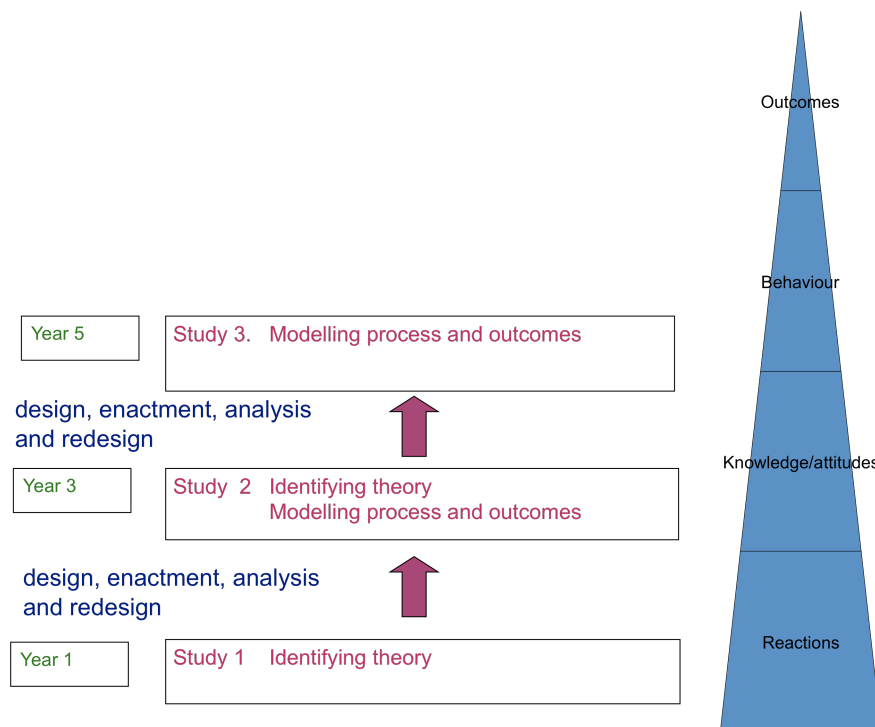
#### **7.2 Discussion of methods**

Before being able to fully discuss the results of studies 1 to 3 in overview, the methods need to be analysed in a rigorous and systematic manner to identify if the interpretation of the results can be relied upon.

As described, in the chapter on methodology, chapter 4, these studies have followed a complex methodological process underpinned by the theoretical perspective of critical enquiry. The overall design followed a series of cycles, which were triggered by the pilot study. This was a piece of action research, which was initiated with the intention of improving the learning process for future cycles of students going through the patient safety program. However, the analysis of data from the focus groups, identified a more theory led direction of enquiry. To explore this further required a different methodological approach, and so this series of studies was developed.

The overall methodological design is shown in a diagrammatic manner in figure 25 below. The framework methodology, which was used in the analysis of the focus group data, originates from public policy research. Many methodologies used in that arena have been developed in health services research field. There are many

similarities between health services research and educational research. Therefore, methods, which have been developed, for use in health services research were considered to be applicable in the design of the studies. The methodological design uses three main theoretical influences. These were explored in chapter 4 and their use analysed and critiqued in the following section of this chapter.



**Figure 11**

**Methodological combinations of MRC Framework, Kirkpatrick and Design based research used in the studies.**

### 7.3 Discussion of use of MRC framework

The first methodological challenge was how to investigate a complex learning situation such as learning about patient safety. The Medical Research Council's (Craig 2008) framework for the evaluation of complex interventions offered an approach to

this via development stage in the framework. This stage included identifying theory and modelling process and outcomes. In order for there to be confidence in the results of these studies, the development stage needed to have been applied in a rigorous manner. Therefore the next section will form a critique of how the development stage in the MRC framework was applied here. The first step was identifying the existing evidence, which was completed via the literature review. The literature review identified overall search terms and then the relevant synonyms were identified that formed the basis of the search. Patient safety as a discipline is formed from a selection of different subject areas, as outlined in chapter 1. In addition students studying medicine have different terms in different countries and so a range of terms were identified for this. Many of the pieces that had been published were not underpinned by original research. Since the original search, there has been an increase in the amount of literature available. Some of this has included review articles, although there has not been a systematic review in terms of the evidence for patient safety curricula in undergraduate medical education. It can be noted in these review articles that all studies identified in the literature research performed for this thesis had been identified in the review articles. This suggests that the literature research had been comprehensive. Additionally, none of the literature replicates the findings of this thesis, however some of the articles support the interpretation of the findings of the studies presented here.

The next step in the MRC framework is that of identifying theory, this could either be to the development of new theory or via establishing connections with the existing theory. In the pilot study both of these methods were used. New theory was identified through the focus group data using the framework analytical process. This is not a



straightforward unidirectional process. Identifying new theory requires detailed analysis of both the data and existing theory. Following this there is a reflective process when new meaning is sought from this combination of sources. In addition, existing theory was used in two distinct ways. The first was in the development of new theory and the second was in the interpretation of some of the themes such as understanding the nature of error. This process was done using a triangulation method, which introduced objectivity into the process, hence improving rigour. These methods could be criticised for being subjective and dependent on the individual. However by use of the triangulation methods, including discussion with colleagues, presentation at conferences and discussion with experts in the field and comparisons with the available literature and theory, it can be considered that reasonable steps were taken in this process to ensure objectivity.

The third step in the MRC framework is that of modelling process and outcomes. In this setting, these were applied using two additional methodological influences. These were Kirkpatrick's framework and design-based research.

#### **7.4 Discussion of use of Kirkpatrick's Framework**

Kilpatrick's framework is a contentious area within educational research in undergraduate medicine (Kirkpatrick 2008, Barr 2000). As it is described, its primary function is to suggest a hierarchy of outcomes, which can be used for the evaluation of an intervention. As such, in medical education it is very hard for any study to rise above level 3, that of behaviour. Influences on healthcare organisation and patient outcomes are very difficult to achieve before graduation in medicine. Therefore, there is concern that many valuable studies in medical education are not considered as

influential because they do not reach these top levels in Kirkpatrick's hierarchy. However each level is interconnected with the ones above and below and so cannot be viewed in isolation. In the literature review it was evident that many studies purely recorded students reactions or knowledge relating to the different headings in patient safety. This is challenging in an educational field where most outcomes occur at behavioural level in the workplace. In this thesis, an attempt has been made to find a middle path through this contradictory situation. These three studies seek to understand the theoretical underpinning of learning about patient safety and how this can be demonstrated in clinical practice. Therefore in this setting Kirkpatrick's framework has provided a valuable “360” of outcomes with which to test a conceptual model.

## **7.5 Discussion of the use of Design Based Theory**

The third influence after Kirkpatrick was that of design-based research. As described in the earlier chapters this also brings a further structure into this complex design. Design-based research explicitly describes what is generally accepted as rigour within research. Educational research in medical education has previously been criticised for not routinely using these principles, which by introducing rigour, improve the quality of the work. This is implicit within the MRC framework where studies go through a review process before being funded. In many settings this is highly competitive which generally improves the quality of the work submitted for funding. In educational research many studies are not funded and therefore do not always go through the same process to refine and improve the study design. To have a cyclical process described which introduces rigour into educational research is very helpful. For example, design-based research emphasises the need for reliable measures, which is a

topic that has been under discussion in educational research in medicine at undergraduate level. By keeping in mind the triad of objectivity, validity and reliability at each step of the design and enactment of the studies, rigour was introduced. This process highlights areas, which will be discussed in this critique of methods, however the awareness of areas of weakness is also a strength in terms of understanding the research process, in order that it could be improved for subsequent studies.

This process identified two areas, which could be perceived as weaknesses within the overall study design. The next section will discuss these two areas, the first being the reliance on existing measures of knowledge, attitudes and behaviours in patient safety and how the reliability of these was considered and the second being the use of correlation within the overall study design.

## **7.6 The importance of reliability**

Testing the concepts, which were identified in the focus group data in study one, and the subsequent testing on the conceptual model identified after study 2, required the identification of appropriate measures of reflective thinking and knowledge and attitudes towards patient safety and error. To develop these independently would have formed the basis of several separate theses; therefore it was decided to use questionnaires that were already available. The questionnaires that were used were the best available when the decision was made to use them. The problems with these questionnaires have been explored in the individual chapters but will be discussed again here. The reflective thinking questionnaire was developed with a range of healthcare professionals, which included both undergraduates and postgraduates. The

applicability of the questionnaire arose from its basis in Mezirow's theories of transformative learning and reflection. The fact that it was very closely aligned to the theories that were identified in study one suggested that it was the most appropriate of the questionnaires available. It had shown acceptable measures of reliability in the evaluation published by Kember in 2000. A similar reliability analysis was carried out in study two, using Cronbach alpha and this showed acceptable levels of reliability within the medical student group used in these studies. Additionally, the patient safety questionnaire had not been fully validated at the time of its use in study two. The information from the team developing the questionnaire was that it was showing acceptable levels of reliability but that these had not been published in the peer-reviewed literature. The subsequent publication of the evaluation of the questionnaire demonstrated that it was a valid tool to be used in study two, and the reliability data in study two was similar to that in the published article. Therefore, although decisions about these questionnaires can be queried, there was a clear rationale in their choice as described in the method section in each of the studies, and the choice has been upheld through the results of the reliability calculations.

In the third study, determining the reliability of the measures of safe behaviour and error became more complex. In study two, the questionnaires were self-administered and the reliability was determined via classical test theory. In study three, behaviours relating to safety and error were measured by external judgment. In this setting classical test theory is not currently considered to be applicable, and as discussed in the methods chapter it was decided to use generalisability theory. This is complex and requires a clear understanding of the process being measured in terms of the relationship between student, assessor and questions about behaviours that are being

assessed. Study three received external support from a researcher with experience in generalisability theory in addition to the principal researcher developing skills in this type of analysis. The generalisability analysis relating to the assessments of safe behaviour in the Ward Simulation Exercise demonstrated a generalisability coefficient very similar to the one calculated by a different method for the cohort overall. Given that the sample had shown no difference in ward simulation exercise scores when the sample means were compared, the similarity in generalisability coefficient supports the validity of the test. Testing the error framework was more complex. As discussed in detail in the previous chapter, error frameworks had been used in the evaluation of interventions for team training and the reliability of the frameworks had been assessed by different methods in the different studies (Morey 2002, McCulloch 2009). One study had used Cronbach alpha which as discussed in chapter 4 was not felt to be an ideal method for identifying the reliability of an external judgment (Morey 2002). The generalisability analysis was carried out, and the generalisability coefficient fell below the level at which judgments are normally deemed to be reliable. However significant relationships between safe behaviour and error across all the error domains were identified. This suggests that error was being measured in a consistent manner. The Cronbach alpha reached an acceptable level. Therefore any inferences about error from study three, need to consider these results. However, the purpose of the study is not to produce a definitive model of reflective thinking, error and safe behaviour, but to establish if this is an avenue that should be explored and how this can be best done. Therefore, any results relating to error need to be considered in light of this reliability but should not be dismissed because of it. This will be discussed further when the conceptual model is discussed.

### 7.7 **Correlation: a flawed or useful approach?**

The other area which may be considered, as a weakness within study is that of is the use of correlation to test the model. Correlation is often considered as a potentially flawed statistical test when applied incorrectly (Altman 1991). In these studies the observations were independent and each variable had one observation from each individual in each of the studies. Each set of variables were measured in specific timeframes within the curriculum as there is a risk that spurious correlations may be calculated if measurement times were not restricted by years within the curriculum. A further risk with correlation is mixed samples. By restricting the study to one cohort of students this reduces any potential misleading correlations via this route. In these studies there has been no attempt to use correlation to demonstrate a change in either reflective ability or knowledge attitudes behaviours relating to patient safety and error. This would be an inappropriate use of correlation in this setting. As discussed in both studies 2 and 3, the sampling is very important. Because of the nature of the ethical approval, convenience samples were recruited for both studies. However attempts were made to understand the representativeness of these convenience samples via the sample means and 95% confidence intervals together with scatter daigrams. In study two, it appeared that the sample might have been a higher achieving group than the cohort overall, although the confidence intervals for the study means overlapped. In study three, it was clearer from the sample means. Confidence intervals and scatter diagram that the sample was representative of the cohort overall. It was decided at the start of study two, to use correlation but the future studies alternative methods of looking at relationships between variables might be explored in order to avoid some of the problems identified with correlation in these studies.

## **7.8 Summary of critique of methods**

The three studies involved in this thesis use an extensive range of methodologies.

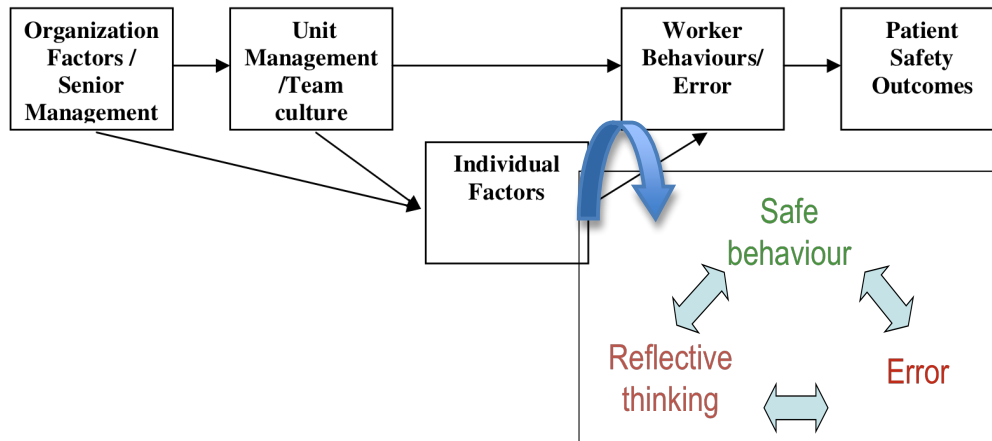
The theoretical perspective of critical enquiry underpinned all the choices of methods.

At each step processes to introduce rigour have been used and by doing this a number of weaknesses have been identified. This in itself could be seen as a strength and the fact that the weaknesses have been identified and addressed in the subsequent studies is of great importance in terms of the overall strength of the methodology in this thesis. The weaknesses in themselves are discussed above and in each of the individual studies. The question at this stage is: where the methods sufficiently objective, valid and reliable to allow valid interpretation of the results?

As this is an ongoing piece of work where the results are not intended to be definitive but to give indications of how this work can be developed in future studies, the conclusion of the author is that it is possible to use these results to establish the conceptual model that arose from the analysis and interpretation in study one.

Therefore the next section in this chapter focuses on a discussion of the conceptual model and how the results from studies one, two and three have influenced the model.

## 7.9 Discussion of the Jackson's model and the conceptual model derived from the studies



**Figure 1**

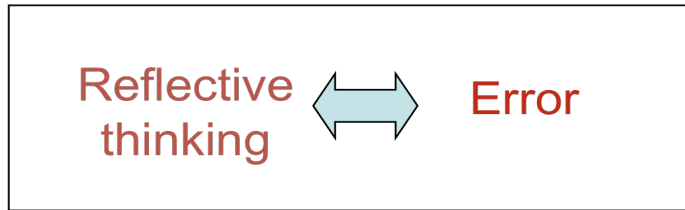
**Key factors influencing patient safety: Jackson, Flin 2009 and the conceptual model of reflection, error and safe behaviour**

The original hypothesis about the role of individual factors has been refined following the results of the three studies. Following study two, intellectual development was removed and the focus placed on reflection. The understanding of the dynamic of reflection, error and safe behaviour in the conceptual model that has developed during these studies is shown below in diagrammatic form. It is made up of three separate diagrams, which represent the results of the three studies and the axes within each diagram represent the dynamic between each element. The nature of these dynamics will be discussed later in this chapter and initially this section will focus on how the results of different studies have influenced the model. The models show how each study has adapted and refined reflection from the original identification of the individual factors from within Jackson's model. The term reflective thinking in the

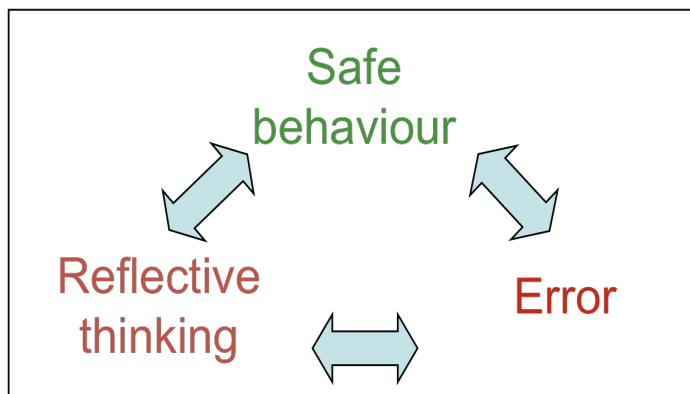


model represents all types of reflective thinking including process and content reflection and critical reflection. The term safe behaviour is intended to represent positive aspects of knowledge attitudes and behaviours relating to patient safety and the term error represents aspects, which may result in unintentional harms occurring.

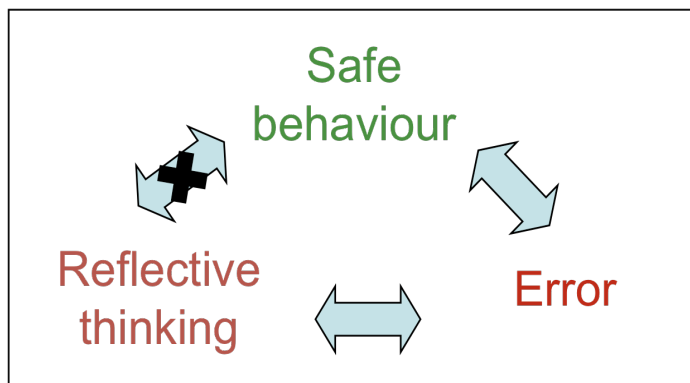
Safe  
behaviour



The dynamic of reflection, error and safe behaviour at the end of study 1



The dynamic of reflection, error and safe behaviour at the end of study 2



The dynamic of reflection, error and safe behaviour at the end of study 3

**Figure 14**

**Overview of the development of the conceptual model for error and reflection**

Before discussing the results in detail there are several points from the theoretical discussion following study one, which should be clarified at this point. Mezirow's work, which has produced the model of transformative learning, suggests that there are varying types of reflection. At a lower level, there is thoughtful action with reflection which he identifies as being an activity that occurs concurrently with action.. At a higher level there is premise or critical reflection, which focuses on learner's questioning the problem itself and the suggestion is with this level of reflection may lead to a transformation of the learner's meaning framework. This occurs after the event and involves an analysis of process and content alongside critical reflection. Therefore, the suggestion is that in many educational settings there should be a focus on critical reflection. The results of these studies suggest that transformative learning theory using critical reflection may offer a partial solution to identifying the processes involved in learning about patient safety but there are elements within the results which suggest different processes are also involved.

At the end of study one, the interpretation had resulted in a conceptual model, which linked reflective thinking to error via the process of transformative learning. When this was explored in study two, safe behaviour was introduced as a concept that should be included within the model. In study three the results suggested returning to the original dynamic of reflective thinking and error. In study two a difference became apparent between thoughtful action with reflection and critical reflection in relation to different constructs within patient safety. Safe behaviour was included within the model. It appeared that thoughtful action with reflection may be linked to positive patient safety behaviours in clinical settings whilst critical reflection was linked to future intentions with regard to patient safety.

In study three, a potential association between higher-level cognitive errors relating to knowledge, and levels of reflective ability, relating to process and content was demonstrated. In study 3, critical reflection was again significantly correlated with planned changes in behaviours following feedback. Whilst the reliability of error framework can be queried and the significance of these results did not reach  $p=0.01$ , a pattern of results has emerged across the two studies, which does not appear to be coincidental. This pattern suggests that there might be a difference between the type of reflective thinking which is associated with skills and behaviours and the type of reflective thinking used for attitudes. This raises a question; are there two different reflective processes occurring when learning about safe practice?

#### **7.10 Discussion of the conceptual model in relation to current evidence**

If these results are looked at against the background literature there is recent research that suggests that this might be the case. One author in the USA has published a number of studies over the last two years, which examine reflection and quality improvement and patient safety (Wittich 2010). Wittich's initial hypothesis is that doctors' ability to engage with quality improvement is dependent on Mezirow's transformative learning theory (Whittich 2010). He has therefore published a number of studies where he developed a tool for assessing critical reflection in doctors reflective writing about quality improvement projects. The validation of this Framework (MERIT) has been published but was unable to demonstrate a significant association between the quality of the projects and levels of critical reflection (Wittich 2010). This failure to demonstrate an association led to the authors suggesting that there was no link between reflection and the ability to identify and appropriate quality improvement opportunities (Whittich 2010). However the results from the studies

presented here suggest that they may not have been measuring the right type of reflective ability that is required for this situation i.e. thoughtful action with reflection rather than critical reflection. Wittich has also published a study, which compared doctors scores on a adaptation of Kember's questionnaire with the doctors characteristics and their knowledge and views on an educational intervention which involved cased based learning about adverse events. Higher levels of reflection were associated with the doctors' views about the generalisability and relevance of the cases but not to the knowledge based aspect of the assessment of the cases. The authors again discussed the role of critical reflection but were unable to demonstrate an association between knowledge about aspects of practice and reflection. This appears to reinforce the results demonstrated here with regard to critical reflection. Wittich amalgamated Kember's four categories into two categories; minimal reflection and higher reflection questions, following a factor analysis. In the subsequent analysis he was unable to identify between the different levels of reflection, which may have influenced the ability to identify a significant result. Wittich's work is of importance to this thesis, in that he has taken a similar line of enquiry but has started with a hypothesis he wished to justify, formed around critical reflection informed by theory and personal observation of practice. By keeping a line of enquiry here with the purpose of clarification as opposed to justification as in Wittich's work a different perspective on reflection in a similar context has emerged.

The findings in this thesis and their relationship to Wittich's work have some implications for current practice, which will be discussed in detail in the following chapter. At this point it is important to reiterate that this is not intended to be a definitive piece of work, and should be seen as the starting point of different line of

enquiry into learning about patient safety. The purpose has been to explore both the conceptual framework and clarify methods that can be applied in future studies.

### **7.11 Understanding the dynamic between error and safe behaviour**

The next part of the model to be discussed is the axis of error and safe behaviour. Study three raises questions about the dynamic between safe behaviour and error in the workplace and how these are related. The correlations showed a high level of significance in the negative correlations between error behaviours in the Ward Simulation Exercise and safe behaviours. This is intuitive, in that error is negatively associated with safe behaviour. The value of the correlation suggests that the measures used in the study were not directly related i.e. they were not measuring the same behaviour but in an opposite direction.

When looking for comparisons for this in the published literature higher cognitive functioning could be used as an example. Knowledge-based error is very similar to clinical reasoning and the work of Croskerry (Croskerry 2003) suggests that metacognition and analytical thinking is associated with reduced cognitive error. A number of recent articles suggest a range of strategies, which in the main, appear to involve elements of reflective thinking. Some describe processes similar to critical reflection (Croskerry 2005) and others to process and content reflection (Ely 2010). Others dispute this connection, suggesting there is insufficient evidence (Norman 2010). However the studies presented in this thesis, support in general terms the concept that thoughtful action with reflection may be protective for high level cognitive error. In many aspects of the literature the distinction between critical reflection after an event and reflection during action, is not clear. This may result in a

perception that a metacognitive process only occurs within critical reflection. The studies presented in this thesis dispute this perception and suggest that metacognition is also involved in thoughtful action with reflection aswell and post-event critical reflection intended to change meaning frameworks.

To discuss this further requires returning to some of the recent articles about clinical reasoning. There are many terms involved in this concept, which overlap in their area of content, as has been shown here. Clinical reasoning is considered to be a positive behaviour, resulting in beneficial outcomes for patients. The flip side is higher level cognitive errors which result in errors and potentially negative outcomes for patients. Work by Coderre (Coderre 2010) ‘in vivo’ using vignettes suggests that asking students to review a diagnosis does not alter a correct first diagnosis but helps students to rectify and incorrect one. This appears to be a form of thoughtful action with reflection, which supports the results described in this thesis.

## **7.12 Summary**

Therefore in summary, these three studies have identified and initiated the preliminary work in establishing a conceptual model involving reflective thinking, error and safe behaviour. The following chapter will discuss the implications this has for current practice and where future research might be directed in this area.

## **Chapter 8**

### **Conclusions**

#### **8.1 Overview**

This concluding chapter uses some of the headings of the introduction to bring together the findings of this thesis in the wider setting of patient safety. As discussed in the introduction, and throughout the thesis, patient safety involves a complex set of knowledge, attitudes and behaviours for health professionals, patients and future practitioners.

Therefore, this chapter will initially focus on what patient safety means for medical students at the end of this thesis. Following this, how patient safety can be measured in medical students will be discussed and then the role of error and reflection in patient safety.

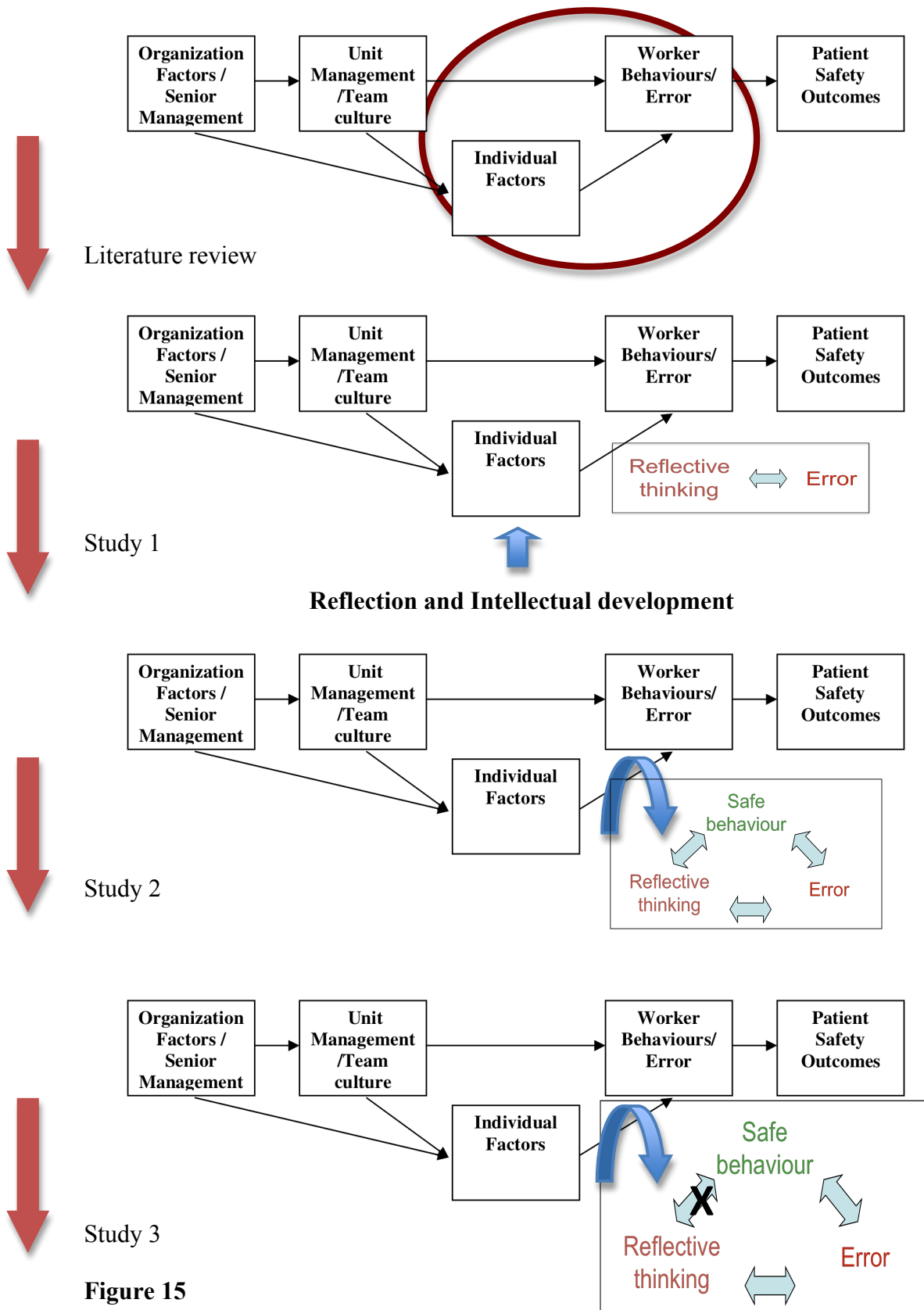
#### **8.2 What does patient safety mean for medical students and what does this thesis add?**

Throughout this thesis Jackson's model has been used to illustrate the influences surrounding patient safety. It has helped to focus the studies and formed the basis for the development of the conceptual model. The impact of individual factors on worker behaviours and error is of particular interest in this thesis. However with medical students, their behaviours are slightly removed from patient safety outcomes in the workplace. As discussed throughout this thesis, medical students rarely impact on patients in a way that influences the outcomes of patient care. Whilst students have contact with patients on a day-to-day basis it is usually in the form of short



encounters, where the student is completing a specific task, such as gathering information or completing an examination. These are important episodes for both the patient and the student and patient safety in these settings focuses on building skills for future practice.

Therefore when considering individual factors relating to worker behaviours and error, the role of this thesis becomes apparent. Understanding the role of reflection in behaviour and error relating to patient safety is important for both educators and students.



**How the conceptual model of reflection**

**As an individual factor for medical students developed from Jackson's model**

### **8.3                   How can we measure patient safety outcomes for medical students and what does this thesis add?**

The background literature review identified, that in many of the studies, which looked at educational interventions relating to patient safety for medical students, the outcome measures were limited to students' reactions or knowledge about patient safety. Very few of the studies identified were able to measure outcomes at behavioural level. While this study did not intend to develop and identify new methods of measuring patient safety, it has modelled approaches to the measurement of patient safety at skills and behavioural level in terms of Kirkpatrick's hierarchy. Demonstrating an ability to measure behaviours in a simulated setting is important in terms of standardisation and offers the opportunity to see if these results are reproducible in other medical schools.

### **8.4                   What individual factors are important for medical students learning about patient safety and what does this thesis add?**

In the WHO document, which discusses human factors in relation to patient safety, cognitive skills and personal resources are identified as factors relevant to the individual worker (World Health Organisation 2009). Within cognitive skills situation awareness and decision-making are identified and stress and fatigue are identified as the personal resources, which impact on individuals in terms of patient safety.

#### **8.4.1               Reflection and error**

The interpretation of the results presented here, suggest that reflective thinking has an influence on higher-level cognitive skills, such as the application of knowledge in context. This is not a new concept that has been developed from these data, but some

of the results of the studies suggest that some approaches to reflective thinking in the context of patient safety might need further investigation. The role of reflection on processes and content was identified in both study two and study three, which challenges some existing educational practices, which focus on critical reflection. The studies in this thesis suggest that there are two distinct reflective processes involved in safe behaviour and error. The research in the published literature focuses on reflection in learning with regard to both knowledge and behaviour. Experiential learning theories frequently focus on behaviours, i.e. psychomotor involvement or physical engagement, with the presumption of altered action at the end of the reflective cycle (Gibbs 1988). Moon (1999) discusses the contradictions involved in the field of experiential learning and how various authors in the field discuss how the learning is formed by the experience or by action without clarity about how the reflective process works. This is because the definition of 'experience' is so broad, that it is hard to define. The overlap between knowledge and action is immense. In health care a focus has been placed on critical reflection in transforming meaning with the expectation of changing behaviour. These results challenge this hypothesis and suggest that a reflective process focusing on problem solving may impact on behaviour without the necessity for critical reflection.

This demonstrates the need to clarify the role of different types of reflection in learning about patient safety. Much emphasis has been placed in patient safety movement on transformative learning, changing practitioners meaning frameworks to enhance safe practice. The results from this thesis suggest an association between reflection on processes and content and a reduced number of higher-level cognitive errors. No association was demonstrated between behaviours and critical reflection.

There were associations in both studies two and three between critical reflection and planned changes to behaviour and future intentions. However intentions and planned changes do not always translate to changes in practice. This is an area, which requires further investigation. The lack of an association replicates work from others interested in this field that have tried, and failed, to identify an association between critical reflection and quality improvement (Wittich 2010).

The role of error has been discussed extensively in terms of high-level cognitive thinking, such as decision-making and problem solving, and there has been extensive research in error across the whole domain patient safety. Error is an area, which is often unpopular with medical students and health professionals. There is a stigma attached to it, which is often unpalatable to medical students. Medical students are a group, who are high achieving, and have often made very few mistakes in their path to medical school. They have come to medical school with a wish to use their individual characteristics for a positive purpose, that of improving patient outcomes. Discussion of error in any form raises the spectre of a perceived failure, rather than the reality of day-to-day practice. Finding ways of addressing this is challenging. The pilot study only occurred because of the negative response to patient safety training in the workplace for the medical students. Many of the issues were shown to be related to organisational issues, but some of these reactions can still be attributed to the stigma of error. Therefore the suggestion that error is a useful medium to initiate learning in patient safety is challenging for medical educators. However the finding that reflection on process and content relating is associated with patient safety may offer a solution to this. Further work is required in this area to test the relationship between lower-level reflective thinking and error behaviours. This study shows

association but the nature of the relationship cannot be inferred from the results of the studies. A future hypothesis that could be tested is that educators do not need to change students meaning frameworks to influence error behaviours, but focussing on reflecting on the process and content of patient safety behaviours may reduce cognitive error.

## **8.5 A comment on reflection and cognition**

The link between cognition and reflection appears recurrently in this thesis. This is an area, which has not been explored extensively in the literature. Cognition is a construct within psychology and although reflection is discussed in the psychological literature in relation to professional development it is not a widely acknowledged construct. However it is a widely utilised phenomenon in healthcare education. Therefore the link between reflection and cognition is difficult to discuss. Moon (Moon1999) tries to explore this via an analysis of how the two terms are used in the literature. Her conclusion is that reflection is a similar process to metacognition but relating to the process of thinking, i.e. thinking about thinking with the implication being that it is a narrower construct than cognition. This is an area which requires further research.

## **8.6 Future work**

The results of this thesis open up opportunities for further work. Two main areas stand out. The first is understanding the dynamic between safe behaviour and error and exploration of the methods which could help to establish the relationship suggested in the results. The second area is that of further exploration of the role reflection plays in higher level cognitive functioning, its link with metacognition and

if reflection could be better utilized to reduce errors in clinical practice

## **8.7 Summary of the thesis**

This thesis has therefore been a series of studies engaged in critical enquiry; seeking to understand and improve our understanding of how students learn about patient safety. The studies have explored how individual characteristics such as reflection influence medical students' views, knowledge and attitudes, and behaviours relating to error and safety. The work presented here has shown how a combination of methodological influences can be used. The methodological approach and the results will help to inform educators and give clear directions for future work that is needed in this area.

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## **Appendices**

### **1. Appendix 1**

#### **Evidence table – Chapter 2**

Buckley et al (2009) BEME quality criteria that result in a score out of 11: any score above 7 is considered to be of higher quality

1. Research question—Is the research question(s) or hypothesis clearly stated?
2. Study subjects—Is the subject group appropriate for the study being carried out?
3. Data collection methods—Are the methods used reliable and valid for the research question and context?
4. Completeness of data—Have subjects dropped out? Is the attrition less than 50%? Is the questionnaire response rate acceptable?
5. Control for confounding—Have multiple factors or variables been removed or accounted for where possible?
6. Analysis of results—Are the statistical or other methods of results analysis used appropriate?
7. Conclusions—Is it clear that the data justify the conclusions drawn?
8. Reproducibility—Could the study be repeated by other researchers?
9. Prospective—Does the study look forwards in time rather than backwards?
10. Ethical issues—Were all relevant ethical issues addressed?
11. Triangulation—Were results supported by data from more than one source?

#### **Key questions to ask in qualitative research Kuper (2008)**

With this set of questions if the majority were positive then the study was categorized as higher quality. The authors suggest that it should not be used as a scoring system but as a guide.

1. Was the sample used in the study appropriate to its research question?

2. Were the data collected appropriately?
3. Were the data analysed appropriately?
4. Can I transfer the results of this study to my own setting?
5. Does the study adequately address potential ethical issues, including reflexivity?

<b>Study</b>	<b>Country of origin</b>	<b>Responding population (of total population studied)</b>	<b>Study design</b>	<b>Patient Safety context</b>	<b>BEME quality grading Outcome (higher score of 7 or above out of 11) Qualitative studies analysed with Kuper's questions</b>	<b>Outcome, including modified Kirkpatrick level of evaluation</b>
Kerfoot 2007	USA	325 second and third year medical students across 2 medical schools	Pre and 2 post intervention questionnaires	3 web based learning modules including overview, error and systems theory	Higher	Satisfaction (Level 1) Knowledge (Level 2B) High satisfaction rating Increase in MCQ test scores compared with baseline (16% increase from baseline) Knowledge sustained across 4 weeks
Halbach 2005	USA	572 third year medical students	Post intervention questionnaire	4 hour intervention with lectures and simulation with SP	Higher	Satisfaction (Level 1) Attitudes (Level 2A) Knowledge (Level 2B) High satisfaction rating High self-reported ratings of attitudes and knowledge regarding error disclosure (7%) reported having disclosed a medical error to a patient
Madigosky 2006	USA	92 second year medical students	Pre and post survey	Introduction to patient care course 10.5 hours of lectures role playing learning exercises focussed on error	Higher	Satisfaction (Level 1) Attitudes (Level 2A) Knowledge (Level 2B) High satisfaction rating 7% reported an error through a formal process



Patey 2007	UK	110 final year medical students	Pre and post survey and at 1 year	2 sessions ( 5 hours lectures, group discussions, audio case Understanding error, factors influencing adverse events, skills required to deal with error,	Higher	Satisfaction (Level 1) Attitudes (Level 2A) Knowledge (Level 2B) theory of planned behaviour but not to level 3 High satisfaction rating Improvement on self assessed attitude and knowledge Majority planned to report medical errors that they make 73%
Moskowitz 2007	USA	Single school 229 third year medical students		1 day program including plenary session small group workshop role playing, including patient safety and medical errors	Lower	Attitudes (Level 2A) Knowledge (Level 2B) Improvement in self-reported attitudes and knowledge on 14 of 21 questionnaire items about safety
Varkey 2007	UK	42 third year medical students	Evaluation of knowledge	Use of an OSCE for prescribing error	Lower	(Level 1 and 2A) weakness is that is using a skills setting but measures only views/attitudes
Gunderson 2009	USA	Single school 18 final year students (multiple disciplines -5)	Post intervention knowledge	Evaluation of one session including didactic teaching, role play and video clips Disclosure of errors and root cause analysis	Lower	Knowledge (2B) small sample No evidence of pre/post so difficult to assess impact of intervention
Paxton 2009	USA	51 medical students (rotating from different years 2,3 and 4)	Pre and post test knowledge and follow up at 6 and 12 months	90 minute Educational session on error	Lower	Knowledge (2B) longer term follow up attempted but sampling across years was confusing.
Hall 2010	USA	146 third year medical students	Attitudes toward patient safety pre and post	2x 1 hour booster patient safety conferences	Higher	Attitudes (2A) and skills/knowledge (2B) This study scored highly and has attempted to compare a

			intervention. Historical control groups	for this group included reflective accounts on patient safety incidents		current cohort with previous cohort that did not have 'boosters' improvement shown no comment about other changes that might have influenced this
Gould 2002	USA	77 second year medical students	Pre and post intervention survey	Small group work, QI project and chart audit	Higher	Satisfaction (Level 1) Attitudes (Level 2A) Knowledge /skills (Level 2B) Behaviour reported but it was health professional behaviour not students so does not go above 2B General dissatisfaction with chart-audit learning experience (16% positive rating) Overall improvement in 27 of 40 survey items measuring self- reported attitudes and knowledge toward QI As above these results included but they related to health professionals actions not the students
O'Connell 2004	USA	Not exact but quote 600 students completed the evaluation over a three year period	Post intervention attitudinal survey comparison between years	4 year programme of intermittent teaching sessions on systems based care	Lower	Attitudes 2A Showed improvement following visit in year 3
Fulton 2004	USA	Faculty 20 medical students 4	Satisfaction /attitudes evaluation post a pilot educational session	error	Lower	Level 1 and 2A minimal information on which to make and informed view on the study small sample
Thompson 2008	USA	55 first year medical students	Descriptive only	5 mandatory weekly 2-hour sessions (total 10 hours) role- playing, audio- video case Systems thinking, errors, root	Lower	No evaluation data

				cause analysis, teamwork		
Kyrkjebø 2006	Norway	12 interprofessional students	Focus groups	teamwork	Lower	Level 2A More appropriate to assess with Kuper's levels rated at lower level
Robertson 2010	USA	213 medical and nursing students	Pre and post intervention survey	Team strategies and patient safety	Higher	Attitudes and Knowledge 2A and 2B recognised difference in behaviours relating to teamwork after watching video
Cooper 2005	UK	237 first year medical students	RIPLS and qualitative data	Teamwork/IPE Lecture then IPE workshops x4 e learning material – control group no intervention	Higher	Level 2A Not really related to patient safety more towards IPE
Horsburgh 2005	New Zealand	300 year 3 medical students (?IP)	Post intervention satisfaction evaluation	QI and system failures course 2 days	Lower	Satisfaction level 1 – minimal data available
Anderson 2009	UK	199 medical and nursing students (94 medical students)	Pre and post intervention survey	Patient safety IP 1 day course	Higher	Attitudes 2A Knowledge 2B Students assimilated curricular aspects relevant to patient safety – covered high numbers of Buckley's criteria scored 10 but still only at knowledge level
Hobgood 2010	USA	235 fourth year medical students from 2 universities	Pre and post attitudes /knowledge questionnaire	1 day teamwork course didactic, role play and simulation	Higher	Attitudes and knowledge/skills 2A and 2B Different approaches did not alter outcomes between groups
Celebi 2008	Germany	74 fifth year medical students	Investigation to see if medical clerkship improved prescribing skills	Medical clerkship and standardised patient scenario with prescription chart	Higher	Skills 2B Interesting study using standardised scenario to see if a specific environment improves prescribing skills no difference found in the number of error between intervention and control group
Denegan 2006	UK	9 (48) final year	Trial	Drug calculation in	Lower	Skills 2B Group with drug

		medical students		simulation scenario		calculation training had significantly better performance
Garbutt 2006	USA	28 year 3 medical students	Pre/post test assessment of prescribing skills	Two 1 hour small group interventions on prescribing with a focus on safety	Lower	Skills 2B Intervention resulted in fewer prescribing errors – no reliability for assessing prescribing error
Scobie 2003	UK	40 final year medical students from 2 schools	Trial of prescribing intervention	Pharmacist based additional teaching involving 5 practical exercises or no additional teaching	Lower	Satisfaction, attitudes and skills as demonstrated in an OSCE. Only improved statistically in 25% of stations
Hunt 2005	UK	200 first year medical students	Attitudinal survey and direct observation of practice	Hand hygiene within an OSCE station	Lower	Attitudes 2A and skills 2B Students overrated their compliance and had poor attitudinal responses
Fisher 2010	Singapore	90 final year medical students	Attitudinal survey	Following training as a hand hygiene auditor	Lower	Attitudes 2A Improved attitudes ? cultural element
Mittal 2011	USA	75 medical students	Attitudinal survey and direct observation of ANTT	Germ simulation	Higher	Improved ANTT skills 2B better than residents following training
Rosenthal 2009	USA	No precise numbers approx 100	Hand hygiene audit data on staff	Students used as auditors	Lower	Effect on staff so ? level 4 but no information about educational effect
Burnett 2008	UK	44 final year medical students	Reflective accounts about cleanliness champions	As part of programme of becoming cleanliness champions 132 reflective accounts	Lower	Brings education theory into practice but very hard to identify quality indicators 3 out of 6)
Marshall 2009	Australia	17 teams of final year medical students	Trial	One group had training on iSBAR the other acted as a control	Higher	Skills 2B A significant difference was identified between the group in terms of content in the handover
Coderre 2010	Canada	67 first year medical students	Measurement of error in diagnosis pre and post a	Prompt given to review their diagnosis	Higher	Skills 2B Querying a diagnosis – if correct students keep to first diagnosis if incorrect

			prompt			more likely to change to right diagnosis
Cahan 2010	USA	148 third year medical students	Mixed first cycle trial with control group and second pre and post with all receiving training	1 day training programme in human factors assessed via work placed based assessment and attitudinal questionnaire	Lower	2A and 2B very difficult to draw conclusion with the combination of methods results suggest improved student – pt communication
Bray-Hill 2010	USA	136 third year medical students	Post intervention evaluataion	Uncertain time but small and large group session	Lower	2A and 2B – comparisons at group level rather than individual
de Feijter 2010	The Netherlands	34 final year medical students	4 focus groups	Activity theory analysis	Higher	Interesting and rates highly on Kuper questions Difficult to place in Kirkpatrick

## **2. Appendix 2**

### Chapter 5 appendices

This questionnaire was published Kember in 2000. The authors explicitly allow it use by others if their original paper is cited:

Kember D, Leung D, Jones A, Yuen Loke A, McKay J, Sinclair K et al Development of a Questionnaire to Measure the Level of Reflective Thinking. *Assessment & Evaluation in Higher Education*, Vol. 25, No. 4, 2000.

### Reflection Questionnaire

For each statement lease circle the answer which indicates your level of agreement about your actions and thinking whilst studying medicine.

**1. When I am working on some activities, I can do them without thinking about what I am doing.**

<i>definitely agree</i>	<i>agree with reservation</i>	<i>definite answer is not possible</i>	<i>disagree with reservation</i>	<i>definitely disagree</i>
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**2. Studying medicine requires us to understand concepts taught by the lecturers.**

<i>definitely agree</i>	<i>agree with reservation</i>	<i>definite answer is not possible</i>	<i>disagree with reservation</i>	<i>definitely disagree</i>
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**3. I sometimes question the way others do something and try to think of a better way.**

<i>definitely agree</i>	<i>agree with reservation</i>	<i>definite answer is not possible</i>	<i>disagree with reservation</i>	<i>definitely disagree</i>
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**4. As a result of studying medicine I have changed the way I look at myself.**

<i>definitely agree</i>	<i>agree with reservation</i>	<i>definite answer is not possible</i>	<i>disagree with reservation</i>	<i>definitely disagree</i>
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**5. In medicine we do things so many times that I started doing them without thinking about it.**

<i>definitely agree</i>	<i>agree with reservation</i>	<i>definite answer is not possible</i>	<i>disagree with reservation</i>	<i>definitely disagree</i>
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**6. To pass medicine you need to understand the content.**

<i>definitely agree</i>	<i>agree with reservation</i>	<i>definite answer is not possible</i>	<i>disagree with reservation</i>	<i>definitely disagree</i>
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**7. I like to think over what I have been doing and consider alternative ways of doing it.**

<i>definitely agree</i>	<i>agree with reservation</i>	<i>definite answer is not possible</i>	<i>disagree with reservation</i>	<i>definitely disagree</i>
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**8. Studying medicine has challenged some of my firmly held ideas.**

<i>definitely agree</i>	<i>agree with reservation</i>	<i>definite answer is not possible</i>	<i>disagree with reservation</i>	<i>definitely disagree</i>
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**9. As long as I can remember handout material for examinations, I do not have to think too much.**

<i>definitely agree</i>	<i>agree with reservation</i>	<i>only to be used if a definite answer is not possible</i>	<i>disagree with reservation</i>	<i>definitely disagree</i>
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**10. I need to understand the material taught by the teacher in order to perform practical tasks.**

<i>definitely agree</i>	<i>agree with reservation</i>	<i>definite answer is not possible</i>	<i>disagree with reservation</i>	<i>definitely disagree</i>
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**11. I often reflect on my actions to see whether I could have improved on what I did.**

<i>definitely agree</i>	<i>agree with reservation</i>	<i>definite answer is not possible</i>	<i>disagree with reservation</i>	<i>definitely disagree</i>
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**12. As a result of studying medicine I have changed my normal way of doing things.**

<i>definitely agree</i>	<i>agree with reservation</i>	<i>definite answer is not possible</i>	<i>disagree with reservation</i>	<i>definitely disagree</i>
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**13. If I follow what the lecturer says, I do not have to think too much on this course.**

<i>definitely agree</i>	<i>agree with reservation</i>	<i>definite answer is not possible</i>	<i>disagree with reservation</i>	<i>definitely disagree</i>
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**14. In medicine you have to continually think about the material you are being taught.**

<i>definitely agree</i>	<i>agree with reservation</i>	<i>definite answer is not possible</i>	<i>disagree with reservation</i>	<i>definitely disagree</i>
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**15. I often re-appraise my experience so I can learn from it and improve for my next performance.**

<i>definitely agree</i>	<i>agree with reservation</i>	<i>definite answer is not possible</i>	<i>disagree with reservation</i>	<i>definitely disagree</i>
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**16. During this course I discovered faults in what I had previously believed to be right.**

<i>definitely agree</i>	<i>agree with reservation</i>	<i>definite answer is not possible</i>	<i>disagree with reservation</i>	<i>definitely disagree</i>
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## Measure of Epistemological Reflection

### Instructions:

This questionnaire asks about your perspectives on your studies. Each question asks about your opinions and the reasons why you have that opinion. We are interested in understanding your perspectives as fully as possible. Please give as much detail as you can to describe how you feel about each question. Please use the back of each page if you need to.

1. Think about the last time you had to make a major decision about your education in which you had a number of alternatives. What was the nature of your decision?
  - What alternatives were available to you?
  - How did you feel about those alternatives?
  - How did you go about choosing from the alternatives?
  - What were the most important considerations in your choice? Please give details
  
2. Do you learn best in sessions that focus on factual information or classes that focus on ideas and concepts?
  - Why do you learn best in the type of class you chose above?
  - What do you see as the advantages of the choice you have made above?
  - What do you see as the disadvantages of the choice you made above?
  - If you could give advice to anyone on how best to succeed in this medical course, what kind of advice would you give them? Explain what you think is the key to doing well.

3. During the course of your studies, you have probably had tutors with different teaching methods. Describe the method which had the most beneficial effect on you.
  - What made that method beneficial? Please be specific and give examples
  - Were there negative aspects to the method? Please explain
  - What are the most important things you learned from the tutor's method of teaching?
  - Please describe the type of relationship with an instructor that would help you to learn best and why
  
- 4 Do you prefer classes in which the students do a lot of talking i.e. contribute to the session or where students don't talk very much?
  - Why do you prefer the type you chose?
  - What do you see as the advantages of your preference?
  - What do you see as the disadvantages of your preference?
  - What sort of interactions would you like to see among members of your class in order to enhance your learning?
  
- 5 Some people think that hard work and effort will result in high exam marks. Others think that hard work and effort are not a basis for high grades. Which of these statements is most like your own opinion?
  - Ideally what do you think should be used as a basis for assessing your work in medical school?
  - Who should be involved in the assessment you described above?
  - Please explain why

- 6 Sometimes tutors give different explanations. When two tutors explain or ask you to do something differently, can one be more correct than the other?
- When two explanations are given for the same situation, how do you go about deciding which explanation to believe? Please give details and examples
  - Can one ever be sure of which explanation to believe? If so, how?
  - If one can't be sure of which explanation to believe, why not?

Baxter Magolda, M. B. (1992). Knowing and reasoning in college: Gender-related patterns in students' intellectual development. San Francisco: Jossey-Bass

## Patient Safety Questionnaire



**UNIVERSITY OF ABERDEEN**

Industrial Psychology Research Centre

Dear Colleague,

The following questionnaire has been designed in order to evaluate current levels of knowledge and attitudes to patient safety.

**Thank you**

### Section 1 Level of Knowledge about Patient Safety

**Please circle the number that best describes your level of knowledge for each item.**

<b>What is your level of knowledge regarding:</b>	<b><u>High</u></b>				<b><u>Low</u></b>
Different types of error?	5	4	3	2	1
Factors contributing to error?	5	4	3	2	1
Factors influencing patient safety?	5	4	3	2	1
Ways of speaking up about error?	5	4	3	2	1
What should happen if an error is made?	5	4	3	2	1
How to report an error?	5	4	3	2	1
The role of the NHS Trusts in error reporting?	5	4	3	2	1
The role of the medical defence unions (e.g. MDDUS) in error reporting?	5	4	3	2	1

### Section 2 Knowledge of Actions to take

**Please circle the number that best describes your level of knowledge for each statement.**

	<u>High</u>				<u>Low</u>
I would know what to say if I made an error.	5	4	3	2	1
I would know who to talk to if I made an error.	5	4	3	2	1
I would know what to do if a member of a healthcare team I'm part of made an error.	5	4	3	2	1
I would know what to do if I witnessed someone more senior than me making a mistake.	5	4	3	2	1
I would know what to do/say if a patient told me I had made an error.	5	4	3	2	1
If I made an error I would want to discuss it with someone.	5	4	3	2	1

### Section 3 Feelings about Making Errors

Please circle the number that best describes your feelings for each statement.

If I made an error I would expect to feel:	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
Afraid	5	4	3	2	1
Ashamed	5	4	3	2	1
Guilty	5	4	3	2	1
Upset	5	4	3	2	1

*Telling others about an error I made would be:*

*Easy\_5\_\_\_4\_\_\_3\_\_\_2\_\_\_1\_Difficult*

*Worthwhile\_5\_\_\_4\_\_\_3\_\_\_2\_\_\_1\_Worthless*

*Acceptable\_5\_\_\_4\_\_\_3\_\_\_2\_\_\_1\_Unacceptable*

*Helpful\_5\_\_\_4\_\_\_3\_\_\_2\_\_\_1\_Unhelpful*

### Section 4 Personal Attitudes to Patient Safety

Thinking about your personal beliefs with regard to patient safety, please circle the number that best describes your own view for each statement.

	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
By concentrating on the causes of incidents I can contribute to patient safety	5	4	3	2	1
If I keep learning from my mistakes, I can prevent incidents.	5	4	3	2	1
Acknowledging and dealing with my errors is an important part of my job.	5	4	3	2	1
It is not appropriate to challenge well-established practices even if they compromise patient safety.	5	4	3	2	1
Being open and honest about the mistakes I make is not acceptable at my place of work.	5	4	3	2	1
Admitting an error I had made would lead to just and fair treatment by the healthcare authorities.	5	4	3	2	1

## Section 5 Safety at the Workplace

**Thinking about your experiences with patient care up until now, please circle the number that best describes your personal view for each statement.**

	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
Healthcare managers think that people in my position should focus on patient safety.	5	4	3	2	1
The healthcare team(s) I work with have always shown exemplary behaviour with respect to patient safety.	5	4	3	2	1
The healthcare team(s) I work with are committed to identifying and addressing patient safety risks.	5	4	3	2	1
The healthcare team(s) I work with would never criticise me for making mistakes.	5	4	3	2	1
The attitude of healthcare managers makes it difficult to report errors.	5	4	3	2	1
Nowadays, healthcare managers are more interested in meeting performance targets than in patient safety.	5	4	3	2	1

## Section 6 Personal Influence over Safety

**Thinking about your own ability to influence patient safety, please circle the number that best describes your personal view for each statement.**

Strongly agree	Agree	Neutral	Disagree	Strongly disagree
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I feel it is easier to find someone to blame rather than focus on the causes of error.	5	4	3	2	1
I feel confident about speaking to someone who is showing a lack of concern for a patient's safety.	5	4	3	2	1
I don't know how to address people who have made a mistake.	5	4	3	2	1
Even if the conditions are not optimal, I always manage to establish practices that ensure patient safety is not compromised.	5	4	3	2	1
I believe that filling in reporting forms will help to improve patient safety	5	4	3	2	1
I feel unable to talk about my own mistakes.	5	4	3	2	1

## Section 7 Your Intentions regarding Patient Safety

**Thinking about your intentions regarding patient safety issues in the next 6 months, please circle the number that best describes your personal view for each statement.**

	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
I will report any errors I make at my place of work	5	4	3	2	1
I intend to challenge any complacency I notice with regard to patient safety issues.	5	4	3	2	1
I intend to clearly communicate my safety expectations to members of my healthcare team(s).	5	4	3	2	1
I will support any members of my healthcare team who are involved in an incident.	5	4	3	2	1
I plan to inform my colleagues about the errors they make.	5	4	3	2	1
I will intervene whenever I think a patient may be exposed to harm.	5	4	3	2	1
I plan to make a point of learning from the mistakes of others.	5	4	3	2	1

## Appendix 3

**Structure of assessment of ward simulation exercise**

<b>General Overview</b>						
Candidate has a good general overview and prioritises appropriately. Candidate conducts all essential tasks and clinical procedures. Delivers an appropriate handover.						
Very Poor Performance			Outstanding Performance			
1	2	3	4	5	N/A	
<b>Clinical Skills</b>						
Candidate demonstrates effective history taking skills. Candidate demonstrates appropriate examination technique and initiates appropriate investigations. Candidate interprets results and makes informed decisions.						
Very Poor Performance			Outstanding Performance			
1	2	3	4	5	N/A	
<b>Critically Ill Patient</b>						
Candidate recognizes, assesses and manages the acutely ill patient appropriately. Candidate demonstrates good time management skills and requests help when required.						
Very Poor Performance			Outstanding Performance			
1	2	3	4	5	N/A	
<b>Prescribing/ Written Documentation</b>						
Candidate demonstrates a safe and appropriate prescribing technique. Candidate completes written tasks. Candidate acknowledges mistakes.						
Very Poor Performance			Outstanding Performance			
1	2	3	4	5	N/A	
<b>Response to Interruptions</b>						
Candidate responds appropriately to interruptions and follows them up. Candidate responds appropriately/ reacts to nursing observation.						
Very Poor Performance			Outstanding Performance			
1	2	3	4	5	N/A	
<b>Communication</b>						
Candidate demonstrates good interpersonal skills with team members, nursing colleague and patients/ relatives. Candidate uses appropriate language, treats patients with respect, respects patient's privacy, and confidentiality.						
Very Poor Performance			Outstanding Performance			
1	2	3	4	5	N/A	



**Health and Safety**

Candidate demonstrates safe practice, prevents cross-infection. Candidate demonstrates insight into errors.

**Very Poor  
Performance**

**Outstanding  
Performance**

1

2

3

4

5

N/A

**What are the candidate's strengths?**

**What areas does the candidate need to improve?**